DRAFT

TRANSITE PIPE REMOVAL ACTION PLAN

YERINGTON MINE SITE

JANUARY 8, 2010

PREPARED FOR:

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LIST OF ACRONYMS AND ABBREVIATIONS

ACM	Asbestos-Containing Material
AHERA	Asbestos Hazard Emergency Response Act
AOC	Administrative Order on Consent
ARAR	Applicable or Relevant and Appropriate Requirement
ARC	Atlantic Richfield Company
Arimetco	Arimetco, Inc.
ASTM	American Society of Testing and Materials
BCL	Background Concentration Limits
CAS	Comprehensive Asbestos Survey
CFR	Code of Federal Regulations
CCZ	Contamination Control Zone
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
EPA	Environmental Protection Agency
GPS	Global Positioning System
HA	Homogeneous-Area
HASP	Health and Safety Plan
HEPA	High-Efficiency Particulate Air
H & S	Health and Safety
HSSE	Health Safety Security Environment
ICP-MS	Inductively Coupled Plasma – Mass Spectrometer
JSA	Job Safety Analyses
MARSAME	Multi-agency Radiation Survey and Assessment of Materials and Equipment Manual
MDD	Maximum Dry Density
MDL	Method Detection Limit
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NAC	Nevada Administrative Code
NEA	Negative Exposure Assessment
NESHAP	National Emission Standards for Hazardous Air Pollutants
NRS	Nevada Revised Statutes
NVLAP	National Voluntary Laboratory Accreditation Program
OSHA	Occupational Health and Safety Administration
OSL	Optically Stimulated Luminescence
OSWER	Office of Solid Waste and Emergency Response
OU	Operable Unit
PEL	Permissible Exposure Limit
PLM	Polarized light Microscopy
PPE	Personal Protective Equipment
PQL	Practical Quantitation Limit
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
RACM	Regulated Asbestos-Containing Material
RAP	Removal Action Plan
RCA	Radiological Control Area
RWA	Regulated Work Area
SOW	Scope of Work
TENORM	Technically-Enhanced Naturally Occurring Radioactive Materials
TLD	Thermo-Luminescent Dosimeters
TDR	Time Domain Reflectometry
TSEA	Task Safety and Environmental Analyses
VLT	Vat Leach Tailings
WAAS	Wide Area Augmentation System
WRA	Work Risk Assessment
bgs	below ground surface
cm^2	square centimeters
cpm	counts per minute
dpm	disintegrations per minute
mg/kg	milligrams per kilogram
pCi/g	picoCuries per gram
μR/hr	micro Roentgens per hour

SECTION 1.0
INTRODUCTION

Atlantic Richfield Company (ARC) has prepared this draft Transite Pipe Removal Action Plan (RAP) for the Yerington Mine Site (Site) pursuant to the *Transite Pipe Removal Action Work Plan - Revision 1* (Work Plan) dated August 19, 2009 (Brown and Caldwell, 2009a). The Work Plan was approved by the U.S. Environmental Protection Agency - Region 9 (EPA) on September 11, 2009. ARC implemented the asbestos inspection and transite pipe characterization program in late September 2009. The removal action is required under the Administrative Order on Consent (AOC) and associated Scope of Work (SOW)[1] dated April 21, 2009 (effective May 1, 2009). The Site is located approximately one-half mile west of the City of Yerington in Lyon County, Nevada (Figure 1-1).

This RAP summarizes field and laboratory data from the September 2009 radiometric survey and sampling program described in the Work Plan, and describes the removal action approach based on these data. The removal action will be performed for transite pipe and associated materials located on accessible portions of the Site (i.e., locations that can safely be accessed by equipment capable of lifting and transporting pipe materials). Transite pipe occurs within five of the eight Operable Units (OUs; Figure 1-2) on the Site identified by the EPA, as indicated below:

- Site-Wide Groundwater (OU-1)
- Pit Lake (OU-2)
- Process Areas (OU-3) - contains transite pipe
- Evaporation Ponds and Sulfide Tailings (OU-4) - contains transite pipe
- Waste Rock Areas (OU-5) - contains transite pipe
- Oxide Tailings Areas (OU-6) - contains transite pipe
- Wabuska Drain (OU-7)
- Arimetco Facilities (OU-8) - contains transite pipe

[1] Administrative Order on Consent and Settlement Agreement for Removal Action and Past Response Costs, Anaconda Copper Mine, Yerington Nevada; U.S. EPA Region IX; CERCLA Docket No. 09-2009-0010.

1.1 Waste Materials and Management

As described in the Work Plan, transite pipe is constructed of asbestos containing materials (ACM) that typically contains above one percent (1%) asbestos, which is regulated as a potentially hazardous material by EPA and the Occupational Health and Safety Administration (OSHA). Depending on their physical characteristics, friable pipe sections may be characterized as regulated ACM (RACM). As described in the Work Plan, transite pipe and associated materials that can be safely accessed by construction equipment (e.g., fork lift and rubber-tired haul trucks) will be placed in the on-Site landfill cell located within the Sulfide Tailings Area.

In addition, localized occurrences of scale within transite pipe sections contain technically enhanced naturally-occurring radioactive materials (TENORM). As described in the Work Plan, transite pipe with bulk radiochemical concentrations above the Site-specific Applicable or Relevant and Appropriate Requirement (ARAR) will be designated as ‘mixed asbestos-TENORM waste’. For the transite pipe removal action, the Site-specific ARAR is defined as a bulk concentration of radium-226 in pipe (+/- pipe scale) that exceeds 15 picoCuries per gram (pCi/g).

Because the State of Nevada does not have regulations applicable to TENORM, the 15 pCi/g bulk concentration criterion from the adjacent State of Utah was selected, and approved by EPA, to designate and manage mixed asbestos-TENORM waste for the transite pipe removal action. Pending approval by EPA, mixed asbestos-TENORM waste will be: 1) placed in a lined on-Site landfill cell; or 2) shipped to an off-Site waste repository that accepts such wastes. The timing of this waste management activity, possibly in conjunction with other TENORM from the Process Areas), is planned to occur after wastes with bulk concentrations below the Site-specific ARAR are placed in the unlined on-Site landfill cell.

1.2 Document Organization

Section 2.0 of this RAP describes the field and laboratory characterization activities that were performed in September 2009 to classify transite pipe material types including EPA oversight activities. Photographs of survey and sample locations, and copies of field logs, are provided in Appendices A and B, respectively. Section 3.0 describes the asbestos analytical results, which are provided in Appendix C. Section 3.0 also summarizes the comprehensive asbestos survey (CAS) and inspection report provided in Appendix D.

Radiometric survey and radiochemical analytical results are summarized in Section 4.0, and Appendix E provides the radiochemical analytical data. Section 4.0 also presents a comparison of radiometric survey and laboratory radiochemical data, and the identification of any mixed asbestos-TENORM waste that exceeds the Site-specific ARAR. Section 5.0 presents the updated plan for the removal action, in part based on the field and laboratory data and Section 6.0 includes the health and safety requirements for implementation of this RAP.

SECTION 2.0
CHARACTERIZATION ACTIVITIES

Transite Pipe characterization activities were implemented in September 2009 in accordance with the inspection and sampling plan presented in the Transite Pipe Removal Action Work Plan - Revision 1 (Work Plan) dated August 19, 2009. The following field activities were performed to identify, quantify and classify transite pipe and associated materials that occur on the Site:

- Comprehensive asbestos survey (CAS);
- Collection of 58 samples for asbestos analysis;
- Collection of 26 samples for radiochemical analysis; and
- Completion of the radiometric survey.

Characterization activities were performed within each homogenous area (HA) for the geographically based occurrences of transite pipe on the Site. The following HAs, depicted in Figures 2-1 through 2-5, were previously identified in the Work Plan (no modifications to the HAs resulted from the 2009 characterization activities):

- HA-1 includes the lay-down area with scattered lengths of transite pipe located in the Waste Rock Area northeast of the open pit.
- HA-2 includes the majority of transite pipe on the Site, with intact and continuous pipeline lengths in the W-3 Waste Rock Area. One segment extends from the Slot Pond around the northeastern portion of the W-3 Waste Rock Area to Burch Drive, following the fence line. A second segment originates close to the southwest corner of the W-3 Waste Rock Area and continues generally north to Burch Drive, where it meets the first segment and the two segments join. A third segment continues along the north side of Burch Drive to the southeast corner of the Process Areas.
- HA-3 includes intact and continuous pipeline lengths and scattered transite pipe materials within the Process Areas.
- HA-4 includes scattered transite pipe materials as well as pipe sections within the Radiological Control Area (RCA) portion of the process areas that, based on previous investigations, exhibit elevated radiometric readings.
- HA-5 includes intact and continuous pipeline lengths along the calcine ditch and scattered transite pipe materials within the Oxide and southern Sulfide Tailings Areas.

- HA-6 includes scattered transite pipe in the northern Sulfide Tailings Area.
- HA-7 includes transite pipe from the north edge of the Anaconda unlined evaporation pond and isolated scattered pipe in the area of the Weed heights sewage ponds.

2.1 Transite Pipe Descriptions

The majority of transite pipe observed at the Site consists of intact pipe runs, primarily in HA-2 with shorter run lengths in HA-3. The remaining occurrences consists of isolated, scattered sticks of pipe, stacked piles of intact pipe and scattered, broken pieces of pipe. Typically, transite pipe consists of 13-foot lengths that range from 8 to 24 inches in outside diameter. The pipe was observed to generally be light gray in color, although some pipe lengths were light-brown to red (most likely due to weathering), and some of the pipe contained a blue-colored liner. Scale was observed on the interiors of select pipe occurrences at sample locations HA-1-06, HA-1-07, HA-4-01, HA-4-02, HA-4-05, HA-7-04, HA-7-05 and HA-7-06. Some exposed pipe ends were observed to contain sediment (i.e., process solutions residue) or soil (possibly wind-blown).

Other observed potential ACM consisted of concrete, clay and asphaltic-containing tar adhered to metal pipe. The metal pipe located within HA-1, HA-5, HA-6 and HA-7 appeared to have an asphaltic coating with a fibrous media-binder. Clay pipe was encountered in HA-7 and concrete pipe that appeared to be unused, stockpiled, sewer pipe, was encountered in HA-4. More detailed information regarding the occurrence and character of transite pipe on the Site subject to the field inspection and characterization activities can be found in Appendices A (photographs), B (field logs) and D (CAS Inspection Report).

2.2 Sample Collection Procedure

Sampling procedures consisted of chipping off the edges of the pipe, collecting broken pieces of pipe and breaking existing pieces of broken pipe. Collected samples included the entire pipe thickness, from interior to exterior wall. In a few locations, where pipe scale was evident and not easily removed, the scale was included in the sample. Sampling was conducted by using amended water/wet methods for picking up the broken pieces of pipe.

A hand-operated sprayer was used to apply a water-based wetting agent/surfactant to the area that was sampled. When destructive sampling was required, the procedure consisted of chipping off the edges of the pipe using a chisel and sledge hammer, with the portion of pipe to be sampled wetted prior to collection using the water-based wetting agent/surfactant to limit dust generation. Following sample collection, a spray-on encapsulant was applied to the exposed portion of the pipe to seal in any asbestos fibers generated during sampling. Sample locations, type of characterization performed and pipe descriptions (e.g., material of construction, presence of liner and approximate pipe diameter) are presented in Table 2-1. Appendix A provides representative photographs of the pipe samples and locations and Appendix B includes copies of field notes recorded in the field log books.

ACM and radiochemical sampling locations, as well as radiometric survey readings, were collected and logged using a Trimball Geo XT handheld Global Positioning System (GPS) unit with an accuracy of one meter or less. The GPS has an integrated receiver that uses Wide Area Augmentation System (WAAS) correction messages to improve GPS accuracy. The sample and survey point locations are shown in Figures 2-2 through 2-5.

For Quality Assurance/Quality Control (QA/QC) purposes, duplicate and matrix spike/matrix spike duplicate (MS/MSD) samples were collected from both asbestos and radiochemical sample locations. Due to the nature of the material being sampled, duplicate samples collected in the field could not be homogenized. Therefore, differences are observed in analytical results between the original and duplicate samples. In these cases, the highest analytical values have been reported as a conservative approach to the transite pipe characterization.

Table 2-1. Transite Pipe Characterization Sample Summary

Location	Asbestos Sample	Rad Sample	Rad Survey	Pipe Description			Comment
				Material	Lined/ Unlined	Approx Outside Diameter Inches	
HA-1 Laydown Area at East End of Pit							
HA-1-01	x	x	x	Transite	L	16	Pipe not in original position. Intact and appeared to be unused. Other end of pipe was saw-cut.
HA-1-02	x		x	Transite	L	8	Intact and appeared to be unused.
HA-1-03	x		x	Transite	L	10	Mostly intact. Some broken shards of pipe in the sampling area.
HA-1-04	x		x	Transite	U	NR	Sample taken from broken piece of pipe collar.
HA-1-05	x	x	x	Transite	U	8	Pipe appeared to be used.
HA-1-06	x		x	Transite	U	8	Inside of pipe contained ~1/8 inch of scale.
HA-1-07		x	x	Transite	NR	10	Scale & sediment included in sample.
HA-1-08-MET	x		x	Coated Metal	U	12	Metal pipe ~40% is bent and crushed. ~50% of pipe is covered with black, asphaltic material.
HA-1-09-MET	x			Coated Metal	U	12	Metal pipe ~40% is bent and crushed. ~50% of pipe is covered with black, asphaltic material.
HA-1-10-MET	x			Coated Metal	U	12	Metal pipe ~40% is bent and crushed. ~50% of pipe is covered with black, asphaltic material.
HA-1-R8			x	Transite	NR	NR	
HA-1-R9			x	Transite	NR	NR	
HA-1-R10			x	Transite	NR	NR	
HA-1-R11			x	Transite	NR	NR	
HA-1-R12			x	Transite	NR	NR	Unused unlined pipe.
HA-2 W-3 Waste Rock Area							
HA-2-01	x	x	x	Transite	L	14	Weathered pipe. Broken pieces of pipe inside. Broken collars nearby. Sample taken from broken piece of pipe.
HA-2-02	x		x	Transite	L	14	Pipe-run. Appeared to be used. No significant scaling inside of pipe.
HA-2-03	x	x	x	Transite	L	14	Sample chipped from disconnected pipe. Pipe end showed slight disintegration of white material with finger pressure.
HA-2-04	x		x	Transite	L	12	No visible scaling or sediment inside pipe. Pipe is weathered. Sample collected from end of pipe run.
HA-2-05	x	x	x	Transite	L	12	Pipe end showed slight disintegration of white-colored material with finger pressure. No scaling in pipe.
HA-2-06	x		x	Transite	L	NR	Sample taken from pile of broken pieces (broken pieces range from 1/8"-10"). No visible sediment or scaling in pipe.
HA-2-07	x	x	x	Transite	L	12	Pipe exists underground except for 1' above grade that was sampled. Weathered and intact. Sediment inside pipe.
HA-2-08		x	x	Transite	L	12	No scaling. Some sediment inside that appeared to be from rainwater deposition.
HA-2-09		x	x	Transite	L	12	No scaling. Some sediment inside that appeared to be from rainwater deposition.
HA-2-10	x	x	x	Transite	L	12	No scaling. Broken pieces in area. Pipe end showed slight disintegration of white material with finger pressure.
HA-2-11	x		x	Transite	NR	NR	Shards of broken collar.
HA-2-R20			x	Transite	NR	NR	
HA-2-R21			x	Transite	NR	NR	
HA-2-R22			x	Transite	NR	NR	
HA-2-R23			x	Transite	NR	NR	

Table 2-1. Transite Pipe Characterization Sample Summary

Location	Asbestos Sample	Rad Sample	Rad Survey	Pipe Description: Material	Lined/ Unlined	Approx Outside Diameter Inches	Comment
HA-2 W-3 Waste Rock Area – Continued							
HA-2-R24			x	Transite	NR	NR	
HA-2-R25			x	Transite	NR	NR	
HA-2-R26			x	Transite	NR	NR	
HA-2-R27			x	Transite	NR	NR	
HA-2-R28			x	Transite	NR	NR	
HA-2-R29			x	Transite	NR	NR	
HA-2-R30			x	Transite	NR	NR	
HA-2-R31			x	Transite	NR	NR	
HA-2-R32			x	Transite	NR	NR	
HA-2-R33			x	Transite	NR	NR	
HA-2-R34			x	Transite	NR	NR	
HA-2-R35			x	Transite	NR	NR	
HA-2-R36			x	Transite	NR	NR	
HA-2-R37			x	Transite	NR	NR	
HA-2-R38			x	Transite	NR	NR	
HA-2-R39			x	Transite	NR	NR	
HA-2-R40			x	Transite	NR	NR	
HA-2-R41			x	Transite	NR	NR	
HA-2-R42			x	Transite	NR	NR	
HA-2-R43			x	Transite	NR	NR	
HA-2-R44			x	Transite	NR	NR	
HA-2-R45			x	Transite	NR	NR	
HA-2-R46			x	Transite	NR	NR	
HA-2-R47			x	Transite	NR	NR	
HA-3 Process Areas							
HA-3-01	x	x	x	Transite	L	12	No scaling in pipe. Sample from chipping off end of pipe run.
HA-3-01-FD	x		x	Transite	L	12	No scaling in pipe. Sample from chipping off end of pipe run.
HA-3-02	x		x	Transite	L	24	Pipe is broken in this area.
HA-3-03	x	x	x	Transite	NR	8	Pipe is very deteriorated. Part of pipe is below grade.
HA-3-03-FD		x	x	Transite	NR	8	Pipe is very deteriorated. Part of pipe is below grade.
HA-3-04	x	x	x	Transite	U	18	No scaling, some sediment in pipe. Pipe exists in a concrete base. Sample chipped off pipe.
HA-3-04-FD	x		x	Transite	U	18	No scaling, some sediment in pipe. Pipe exists in a concrete base. Sample chipped off pipe.
HA-3-05	x		x	Transite	L	24	Four-stick pipe run. No scaling. Pipe full of sediment, which also occurs around the pipe.
HA-3-R48			x	Transite	NR	NR	
HA-3-R49			x	Transite	NR	NR	
HA-3-R50			x	Transite	NR	NR	
HA-3-R51			x	Transite	NR	NR	
HA-3-R52			x	Transite	NR	NR	
HA-3-R53			x	Transite	NR	NR	
HA-3-R54			x	Transite	NR	NR	

Table 2-1. Transite Pipe Characterization Sample Summary

Location	Asbestos Sample	Rad Sample	Rad Survey	Pipe Description: Material	Pipe Description: Lined/ Unlined	Pipe Description: Approx Outside Diameter Inches	Comment
HA-4 Radiological Control Area (RCA)							
HA-4-01	x	x	x	Transite	NR	14	Pipe is heavily scaled. Outside of pipe is weathered. Scale ranges from 3/8"-1".
HA-4-02	x	x	x	Transite	NR	14	Pipe is heavily scaled. Outside of pipe is weathered. Scale ranges from 3/8"-1".
HA-4-02-FD		x	x	Transite	NR	14	Pipe is heavily scaled. Outside of pipe is weathered. Scale ranges from 3/8"-1".
HA-4-03	x	x	x	Transite	L	10	Isolated stick of pipe. Heavily weathered. Broken pieces of pipe scattered throughout the area.
HA-4-04	x	x	x	Transite	L	24	Mostly intact pipe. Some broken pieces of pipe in the area. No scaling.
HA-4-05	x		x	Transite	NR	14	Weathered pipe with scale inside. Broken ends not crushable with finger pressure. Sample taken from broken piece.
HA-4-06	x	x	x	Concrete	U	12	Concrete pipe, most likely unused sewer pipe. Appears to have been stockpiled in this area.
HA-4-07	x		x	Concrete	U	12	Concrete pipe, most likely unused sewer pipe. Appears to have been stockpiled in this area.
HA-4-08	x		x	Concrete	U	12	Concrete pipe, most likely unused sewer pipe. Appears to have been stockpiled in this area.
HA-4-R1			x	Transite	NR	NR	
HA-4-R2			x	Transite	NR	NR	
HA-4-R3			x	Transite	NR	NR	
HA-4-R4			x	Transite	NR	NR	
HA-4-R5			x	Transite	NR	NR	
HA-4-R6			x	Transite	NR	NR	
HA-4-R7			x	Transite	NR	NR	
RCA Pipe #1			x	Transite	NR	NR	
RCA Pipe #2			x	Transite	NR	NR	
RCA Pipe #3			x	Transite	NR	NR	
RCA Pipe #4			x	Transite	NR	NR	
RCA Pipe #5			x	Transite	NR	NR	
RCA Pipe #6			x	Transite	NR	NR	
RCA Pipe #7			x	Transite	NR	NR	
RCA Pipe #8			x	Transite	NR	NR	
RCA Pipe #9			x	Transite	NR	NR	
RCA Pipe #10			x	Transite	NR	NR	
RCA Pipe #11			x	Transite	NR	NR	
HA-5 Oxide Tails/South Sulfide Tails							
HA-5-01	x		x	Transite	L	8	One isolated stick of pipe. Sample taken from broken piece of pipe near the pipe stick.
HA-5-02	x	x	x	Transite	L	8	Contains sediment. No scaling. Sample taken from broken piece nearby. Outside of pipe shows greenish coloration.
HA-5-02-FD	x		x	Transite	L	8	Contains sediment. No scaling. Sample taken from broken piece nearby. Outside of pipe shows greenish coloration.
HA-5-03-MET	x		x	Coated Metal	U	12	No visible scaling inside pipe. Metal pipe contains asphaltic coating with fibrous media-binder.

Table 2-1. Transite Pipe Characterization Sample Summary

Location	Asbestos Sample	Rad Sample	Rad Survey	Pipe Description: Material	Pipe Description: Lined/ Unlined	Pipe Description: Approx Outside Diameter Inches	Comment
HA-5 Oxide Tails/South Sulfide Tails – Continued							
HA-5-03-MET-FD	x		x	Coated Metal	U	12	No visible scaling inside pipe. Metal pipe contains asphaltic coating with fibrous media-binder.
HA-5-04	x	x	x	Transite	L	8	No scaling visible in pipe. Sample area is a separated bend in the pipe run.
HA-5-04-FD	x	x	x	Transite	L	8	No scaling visible in pipe. Sample area is a separated bend in the pipe run.
HA-5-05	x			Transite	L	NR	Sample from small shard.
HA-5-06	x		x	Transite	L	8	Sample taken from separation in pipe run.
HA-5-R55			x	Coated Metal	NR	NR	
HA-6 North Sulfide Tailings							
HA-6-01	x		x	Transite	NR	16	Weathered stick of isolated pipe.
HA-6-02	x	x	x	Transite	L	16	Weathered stick of isolated pipe. Some sediment in pipe. Appears to have been relocated to this area.
HA-6-03	x		x	Transite	L	16	Weathered pipe. Four sticks of pipe in this area.
HA-6-04-MET	x		x	Coated Metal	U	16	Metal pipe contains asphaltic coating with fibrous media-binder.
HA-6-05-MET	x		x	Coated Metal	U	16	Metal pipe contains asphaltic coating with fibrous media-binder.
HA-6-06-MET	x		x	Coated Metal	U	16	Metal pipe contains asphaltic coating with fibrous media-binder.
HA-6-R16			x	Transite	NR	NR	
HA-6-R17			x	Transite	NR	NR	
HA-6-R18			x	Transite	NR	NR	
HA-6-R19			x	Transite	NR	NR	
HA-7 Evaporation Ponds							
HA-7-01	x		x	Clay	U	15	Clay pipe trending to the north. The majority of the pipe is below grade, under roadway.
HA-7-02	x	x	x	Transite	U	22	Pipe set in cement bottom. Bottom half encased in 24" of concrete. Heavily weathered. Full of sediment.
HA-7-03	x		x	Transite	U	22	Pipe set in cement bottom. Bottom half encased in 24" of concrete. Heavily weathered. Full of sediment.
HA-7-04	x	x	x	Transite	L	9	Weathered pipe. Contains scale inside. Runs north, below grade, under roadway.
HA-7-05	x		x	Transite	L	9	Weathered pipe. Contains scale inside. Runs north, below grade, under roadway.
HA-7-06	x		x	Transite	L	9	Weathered pipe. Contains scale inside. Runs north, below grade, under roadway.
HA-7-07	x		x	Transite	U	22	Pipe set in cement bottom. Bottom half encased in 24" of concrete. Heavily weathered. Full of sediment.
HA-7-08-MET	x		x	Coated Metal	U	24	Metal pipe with asphaltic material coating on less than 50% of pipe.
HA-7-09-MET	x			Coated Metal	U	24	Metal pipe with asphaltic material coating on less than 50% of pipe.
HA-7-10-MET	x			Coated Metal	U	24	Metal pipe with asphaltic material coating on less than 50% of pipe.
HA-7-R15			x	Transite	NR	NR	

Note: L - Lined pipe, U - Unlined pipe and NR - Not recorded

2.3 Asbestos Containing Material Sampling

Sampling of transite pipe in the HAs for asbestos analysis was performed by an Asbestos Hazard Emergency Response Act (AHERA) accredited inspector in accordance with OSHA 29 CR 1926.1101(b) Class III Work. Samples for asbestos analysis were collected according to AHERA protocol using the following criteria:

- For homogenous ACM less than 1,000 linear feet or square feet, a minimum of three (3) bulk samples were collected from each HA.
- For homogeneous ACM from 1,000 up to 5,000 linear feet or square feet, a minimum of five (5) bulk samples were collected from each HA.
- For homogenous ACM greater than 5,000 linear or square feet, a minimum of seven (7) bulk samples were collected from each HA.
- For lengths of wrapped metal pipe, or other construction material (e.g. concrete or clay), less than 100 linear feet, a minimum of three (3) samples were collected.
- For all other areas, a minimum of seven (7) samples of suspect-asbestos containing pipe were collected.

Transite pipe sections, and other pipe materials (when observed), were selected within each HA for asbestos sampling based on visual observations of pipe condition and accessibility. Samples for ACM, weighing approximately 5 grams each or one inch in diameter, were collected in double-bagged, Ziploc-type bags. The double-bagged samples were individually marked with unique sample identification numbers. The asbestos samples were documented on a chain-of-custody and were submitted to Asbestos TEM Laboratories, Inc. (Sparks, NV), a National Voluntary Laboratory Accreditation Program (NVLAP) affiliated laboratory.

The samples were analyzed using Polarized Light Microscopy (PLM) methods in accordance with EPA Method 600/R-93/116 or 600/M4-82-020 for the determination of asbestos fibers. Analytical results for the asbestos-containing transite pipe samples are discussed in Section 3.0.

2.4 Radiometric Survey and Radiochemical Sampling

The radiometric survey, and associated radiochemical sampling program, was performed in conjunction with the asbestos sampling program. The radiometric survey was conducted in order to confirm the presence or absence of mixed asbestos-TENORM waste that could occur as pipe scale and localized accumulations of sediment within the transite pipe. As described in the Work Plan, the radiometric survey data would: 1) serve as sentinel measurements during the removal action; and 2) fulfill the function described in Section 2.2.4 of the *Multi-agency Radiation Survey and Assessment of Materials and Equipment Manual* (MARSAME Manual; EPA, 2009). Radiometric data and radiochemical analytical results are discussed in Section 4.0 and presented in Appendix E.

The radiometric survey was initiated in HA-4 at known locations of isolated pipe segments with elevated radiometric readings where the interior of the pipe segments could be accessed by the survey instruments. Starting in HA-4 allowed for the potential calibration of gamma readings with radiochemical analytical data. The survey included gamma readings and mixed field readings (also referred to as gross alpha/beta readings). Gamma readings were measured on the inside of the pipe and the outside of the pipe (both top and bottom). Alpha/beta readings were measured on the inside of the pipe only. Gamma radiation background readings were obtained at waist level and recorded once the instrument reading stabilized at distances of up to 25 feet from the pipe/ACM debris (i.e., a distance beyond the influence of the pipe or ACM debris).

The majority of the measurements were taken at intervals along the outside length of the pipe runs and, wherever possible, at potential debris/scale accumulation points within the pipe such as local low spots, valves, elbows, pipe joints and holes or breaks in intact pipe. Where pipe segments had terminated or disconnected, allowing access to the interior of the pipe, a gamma measurement was taken both inside and outside of the pipe and an alpha/beta measurement was taken inside of the pipe. In addition, both gamma and alpha/beta measurements were taken at asbestos and radiochemical sample locations.

Gamma readings were measured in micro Roentgens per hour (μR/hr) with a Ludlum model 2241-3 digital survey meter using a Ludlum model 44-2 NaI detector probe calibrated with radium-226, which has similar response characteristics as a tissue-equivalent meter (e.g., Bicron μ-rem meter) for NORM radiation exposure. Alpha/beta readings were measured in counts per minute (CPM) with a Ludlum model 2241-3 digital survey meter using a Ludlum model 44-9 G-M detector probe. Both detectors were factory calibrated on July 8, 2009 by Ludlum Measurement Inc. Response checks of the survey meters were conducted daily using the Cesium 137 source that is permanently affixed to the side of the Ludlum model 2241-3.

Samples for radiochemical analysis were, in general, collected at locations selected for ACM samples and were collected in a manner suitable for determining radiochemical concentrations averaged over the entire pipe wall thickness (i.e., the sample consisted of a portion of pipe including the full thickness of the pipe wall including the surface scale and deposits, where applicable, on the inner pipe wall).

Samples were placed in double-bagged Ziploc-type bags (approximately 500 grams each), and were individually marked with a unique sample number. The samples were documented on a chain-of-custody form and were submitted to TestAmerica Richland (Richland, WA) and analyzed for Ra-226 and Ra-228 and for total uranium and total thorium in accordance with Method E901.1 (gamma spectroscopy) and EPA Method 6020 (ICP-MS), respectively.

Following the receipt of analytical results of the bulk radiochemical concentrations of the transite pipe, ARC determined that the collection of a limited number of scale samples from areas of elevated radiometric readings and radiochemical concentrations would: 1) support limited decontamination activity for loose scale in the transite pipe, described below in Sections 4.4 and 5.2; and 2) develop an upper concentration value expected for mixed asbestos-TENORM waste for transite pipe from HA-1 and HA-4. Three locations (HA-1-07, HA-4-01 and HA-4-02) where pipe scale was observed on the interior pipe walls were selected for discrete scale sampling because of the observed elevated radiometric readings and the radiochemical analytical results.

The three scale samples were collected on November 24, 2009, and submitted to TestAmerica for U and Th (EPA Method 6020) and Ra-226/228 (E901.1 gamma spectroscopy). The scale sample collected at location HA-1-07: 1) was observed to be a white, fine-grained scale with a 'chalky' consistency that was approximately 1/8-inch thick; and 2) contained little to no ACM, and was easily separated from the pipe (similar to the planned limited decontamination activity to be performed during the removal action). The 'scale' samples from HA-4-01 and -02 consisted of red-stained and flaky friable transite pipe material (i.e., RACM) collected from within the pipe interior that had been degraded by process solutions. These two samples likely contained some remnant asbestos.

2.5 Inaccessible Pipe

Some pipe locations could not be accessed for health and safety reasons and were not subjected to characterization during the field activities. Inaccessible pipe locations encountered during the characterization activities include the following:

- Three runs of pipe in HA-2, located north of the slot heap leach pad that run generally north-south and terminate off of the edge of a high wall.
- Scattered sticks and broken pieces of pipe in HA-4, located within the below-grade storage vault.
- Pipe observed to be inside a vault/valve box in the northwest area of HA-3.
- Pipe that runs through the culvert under Birch Drive in HA-2.
- Pipe runs that appear to be mostly buried on the north side of W-3, near Burch Drive.
- Several areas on site contain pipe that is partially buried.

2.6 EPA Oversight

EPA provided oversight of the sampling activities and radiometric survey during implementation of the work activities by having contracted personnel from CH2MHill on Site for two days. Ms. Ilke Dinkleman observed the asbestos and radiochemical sample collection activities as well as the radiological survey on September 27 and 28, 2009.

SECTION 3.0
ASBESTOS ANALYTICAL DATA

3.1 Analytical Results

As described in Section 2.1, 58 asbestos samples were shipped to Asbestos TEM Laboratories, Inc. (Sparks, NV), an NVLAP-affiliated laboratory. The samples were analyzed using Polarized Light Microscopy in accordance with EPA Method 600/R-93/116 or 600/M4-82-020 for the determination of asbestos fibers. The asbestos analytical laboratory reports are presented in Appendix C.

Asbestos contents greater than 1% were present in all cement transite pipe sampled during the characterization event. Asbestos contents greater than 1% were also present in two of the three coated metal pipes that were analyzed from HA-6 (HA-6-05-MET and HA-6-06-MET). Asbestos was not detected in the remaining coated metal pipes analyzed from HA-1, HA-5 and HA-7. In addition, asbestos was not detected in the clay pipe encountered in HA-7 or in the concrete pipe encountered in HA-4. Table 3-1 lists all sample locations, asbestos analytical results and pipe material type for the asbestos characterization.

Data Verification was completed to confirm that all submitted analyses were completed by the methods requested. The complete set of asbestos data has been uploaded to the project database.

Table 3-1. Asbestos Analytical Results

Sample Location	Asbestos Type	Asbestos Result (%)	Pipe Material
HA-1 Laydown Area at East End of Pit			
HA-1-01	Chrysotile Crocidolite	10-20% 1-5%	Transite
HA-1-02	Chrysotile Crocidolite	10-20% 1-5%	Transite
HA-1-03	Chrysotile Crocidolite	10-20% 1-5%	Transite
HA-1-04	Chrysotile Crocidolite	10-20% 1-5%	Transite

Table 3-1. Asbestos Analytical Results

Sample Location	Asbestos Type	Asbestos Result (%)	Pipe Material
HA-1 Laydown Area at East End of Pit - Continued			
HA-1-05	Chrysotile	20-30%	Transite
HA-1-06	Chrysotile	30-40%	Transite
HA-1-08-MET	None Detected		Coated Metal
HA-1-09-MET	None Detected		Coated Metal
HA-1-10-MET	None Detected		Coated Metal
HA-2 W-3 Waste Rock Area			
HA-2-01	Chrysotile Crocidolite	10-20% 1-5%	Transite
HA-2-02	Chrysotile Crocidolite	10-20% 5-10%	Transite
HA-2-03	Chrysotile Crocidolite	10-20% 5-10%	Transite
HA-2-04	Chrysotile Crocidolite	10-20% 5-10%	Transite
HA-2-05	Chrysotile Crocidolite	10-20% 5-10%	Transite
HA-2-06	Chrysotile Crocidolite	10-20% 5-10%	Transite
HA-2-07	Chrysotile Crocidolite	10-20% 5-10%	Transite
HA-2-10	Chrysotile Crocidolite	10-20% 5-10%	Transite
HA-2-11	Chrysotile Crocidolite	10-20% 5-10%	Transite
HA-3 Process Areas			
HA-3-01	Chrysotile Crocidolite	10-20% 5-10%	Transite
HA-3-01-FD	Chrysotile Crocidolite	10-20% 5-10%	Transite
HA-3-02	Chrysotile Crocidolite	10-20% 5-10%	Transite
HA-3-03	Chrysotile Crocidolite	10-20% 1-5%	Transite
HA-3-04	Chrysotile Crocidolite	10-20% 1-5%	Transite
HA-3-04-FD	Chrysotile Crocidolite	10-20% 1-5%	Transite
HA-3-05	Chrysotile Crocidolite	10-20% 1-5%	Transite
HA-4 Radiological Control Area (RCA)			
HA-4-01	Chrysotile Crocidolite	10-20% 1-5%	Transite

Table 3-1. Asbestos Analytical Results

Sample Location	Asbestos Type	Asbestos Result (%)	Pipe Material
HA-4 Radiological Control Area (RCA) - Continued			
HA-4-02	Chrysotile Crocidolite	10-20% 1-5%	Transite
HA-4-03	Chrysotile Crocidolite	10-20% 1-5%	Transite
HA-4-04	Chrysotile Crocidolite	10-20% 1-5%	Transite
HA-4-05	Chrysotile Crocidolite	10-20% 1-5%	Transite
HA-4-06	None Detected		Concrete
HA-4-07	None Detected		Concrete
HA-4-08	None Detected		Concrete
HA-5 Oxide Tails/South Sulfide Tails			
HA-5-01	Chrysotile Crocidolite	20-30% 1-5%	Transite
HA-5-02	Chrysotile Crocidolite	20-30% 1-5%	Transite
HA-5-02-FD	Chrysotile Crocidolite	20-30% 1-5%	Transite
HA-5-03-MET	None Detected		Coated Metal
HA-5-03-MET-FD	None Detected		Coated Metal
HA-5-04	Chrysotile Crocidolite	20-30% 1-5%	Transite
HA-5-04-FD	Chrysotile Crocidolite	20-30% 1-5%	Transite
HA-5-05	Chrysotile Crocidolite	20-30% 1-5%	Transite
HA-5-06	Chrysotile Crocidolite	20-30% 1-5%	Transite
HA-6 North Sulfide Tailings			
HA-6-01	Chrysotile Crocidolite	20-30% 1-5%	Transite
HA-6-02	Chrysotile Crocidolite	20-30% 1-5%	Transite
HA-6-03	Chrysotile Crocidolite	20-30% 1-5%	Transite
HA-6-04-MET	None Detected		Coated Metal
HA-6-05-MET	Chrysotile	30-40%	Coated Metal
HA-6-06-MET	Chrysotile	50-60%	Coated Metal
HA-7 Evaporation Ponds			
HA-7-01	None Detected		Clay
HA-7-02	Chrysotile Crocidolite	20-30% 1-5%	Transite

Table 3-1. Asbestos Analytical Results

Sample Location	Asbestos Type	Asbestos Result (%)	Pipe Material
HA-7 Evaporation Ponds - Continued			
HA-7-03	Chrysotile Crocidolite	20-30% 1-5%	Transite
HA-7-04	Chrysotile Crocidolite	20-30% 1-5%	Transite
HA-7-05	Chrysotile Crocidolite	20-30% 1-5%	Transite
HA-7-06	Chrysotile Crocidolite	20-30% 1-5%	Transite
HA-7-07	Chrysotile Crocidolite	20-30% 1-5%	Transite
HA-7-08 MET	None Detected		Coated Metal
HA-7-09 MET	None Detected		Coated Metal
HA-7-10 MET	None Detected		Coated Metal

3.2 CAS Summary

According to the results of the laboratory analyses, the cementatious pipe and asphaltic-wrapped metal pipe located on the Site contain greater than 1% asbestos. Positive identification of ACM means that the quantity of asbestos in the samples were detected by the laboratory in concentrations exceeding the National Emission Standards for Hazardous Air Pollutants (NESHAP) regulatory threshold of greater than one percent (1%) asbestos by weight. The CAS indicates the following:

- Transite pipe on the Site is classified as CAT II non-friable ACM that has been locally degraded and has the potential to degrade (i.e., become crumbled, pulverized or reduced to a powder) during the removal action. The disturbance of these materials during removal is regulated under the NESHAP regulation and by OSHA.
- The asphaltic-coated metal pipe on site is classified as CAT II non-friable ACM that has been locally degraded and has the potential to degrade (i.e., become crumbled, pulverized or reduced to a powder) during the removal action. The disturbance of these materials during removal is regulated under the NESHAP regulation and by OSHA.

Based on the CAS finding and conclusions reached, ARC recommends that all transite pipe and associated materials be classified as RACM, and that the following elements be implemented for the transite pipe removal action:

- A NESHAP notification form should be completed for the removal action, including the presence of RACM. The Asbestos Abatement Project Notification Form (i.e., NESHAP form) should be completed by the abatement contractor and submitted to the Nevada Division of Industrial Relations, Occupational Safety and Health Administration, Northern District Office in accordance with the regulatory requirements. During the removal action, the ACM is to be handled, removed and disposed in accordance with § 61.140 et seq.
- The disturbance of RACM by the removal action is classified by OSHA as Class II asbestos work, and will require compliance with applicable sections of § 29 Code of Federal Regulations (CFR) 1926.1101 (i.e., certified asbestos worker required).
- RACM will be sprayed with amended water and an encapsulant prior to transportation to the proposed on-Site landfill. Particular attention should be given to broken or damaged areas of the pipe. Broken pieces of pipe should be sprayed with amended water, encapsulated and placed in bags prior to transportation to the landfill. A licensed asbestos abatement contractor should be retained to perform the abatement of the ACM in accordance with § 61.140 et seq. and § 29 CFR 1926.1101 et seq.
- A Negative Exposure Assessment to assess the release of asbestos fibers during abatement should be conducted by a Certified Industrial Hygienist

The CAS Inspection Report, prepared by an AHERA-accredited inspector, is presented in Appendix D. The CAS Inspection Report does not address the occurrence of mixed asbestos-TENORM waste, as defined in Section 1.1 of this RAP.

SECTION 4.0
RADIOLOGICAL CHARACTERIZATION

Results of radiometric surveys and laboratory analyses of collected samples consistently indicated 'near-background' values for the transite pipe and associated materials within all HAs with the exception of localized pipe sections in HA-1 (e.g., sample location HA-1-07) and HA-4 (RCA sample locations HA-4-01 and HA-4-02). Radiometric survey and radiochemical analytical results are provided in Appendix E. This section of the RAP also provides conclusions and recommendations for radiometric surveys of transite pipe during the removal action based on the results of the radiological characterization activities.

4.1 Survey Results

<u>Gamma Surveys</u>

Gamma radiation exposure rate results for transite pipe from exterior measurements exhibited: 1) gross exposure rates that ranged from 12 to 1,400 μR/hr; and 2) net results that ranged from -25 to 1,371 μR/hr (the difference between net and gross is the local background value, which can vary from one location to the next).[2] With the exception of the elevated readings noted above in HA-1 and HA-4, all other locations ranged from 12 to 44 gross μR/hr (-25 to 3 net μR/hr).

Gamma radiation exposure rate results from interior measurements of the transite pipe generally exhibited gross exposure rates that ranged from 15 to 43 gross μR/hr, equivalent to a range of net exposure rates from -18 to 2 μR/hr. The highest interior measurements were 3,200 gross μR/hr (3,171 net μR/hr) at location HA-4-02. Interior and exterior measurements at each location were generally consistent (i.e., the variance between the interior and exterior measurements did not exceed 5 μR/hr).

[2] Negative readings mathematically result when the measured background is higher than the measurement taken of the pipe section, which occurs when radiochemical concentrations inside the pipe are low and the walls of the pipe shield the detector from background radiation. Negative readings equate to very low values of radiation.

The only exception to this was observed in HA-4, which exhibited significantly higher interior readings due to the presence of pipe scale or sediment. Figures 4-1a/b and 4-2a/b illustrate the gross and net exterior and interior gamma radiation exposure rate results, respectively. Because a few very high readings were measured in HA-1 and HA-4, these figures provide both arithmetic and logarithmic scales to more clearly illustrate the data.

Table 4-1 summarizes gamma survey gross exposure rate results for measurements taken at any location along the exterior of the transite pipe. Table 4-2 summarizes gamma survey net exposure rate results for measurements taken along the top of the pipe sections. The results for each measurement location are provided in Appendix E.

Table 4-1. Exterior Gamma Survey Results, Gross µR/hr

Area	Max	Min	Average	Median
HA-1	55	12	18	14
HA-2	26	16	20	20
HA-3	28	17	21	20
HA-4	1,400	22	150	35
HA-5	63	18	30	28
HA-6	24	15	20	20
HA-7	52	28	39	39

Table 4-2. Exterior Gamma Survey Results, Net µR/hr

Area	Max	Min	Average	Median
HA-1	35	-8	-2	-6
HA-2	4	-3	-1	-1
HA-3	1	-3	-1	-1
HA-4	1,363	-25	140	28
HA-5	1	-10	-3	-1.5
HA-6	3	-4	0	0
HA-7	21	-12	1	0

Table 4-3 summarizes gamma survey gross exposure rate results for measurements taken within the pipe interiors while Table 4-4 summarizes gamma survey net exposure rate results for the same measurements. The results for each measurement location are provided in Appendix E.

Table 4-3. Interior Gamma Survey Results, Gross µR/hr

Area	Max	Min	Average	Median
HA-1	150	14	27	15
HA-2	29	16	21	20
HA-3	27	17	21	21
HA-4	3,200	20	517	34
HA-5	29	20	24	23
HA-6	21	17	19	20
HA-7	77	28	42	41

Table 4-4. Interior Gamma Survey Results, Net µR/hr

Area	Max	Min	Average	Median
HA-1	130	-6	7	-5
HA-2	7	-4	0	0
HA-3	1	-3	-1	-1.5
HA-4	3,163	-18	208	0
HA-5	2	-10	-2	0.5
HA-6	1	-2	0	0
HA-7	50	-11	10	-1

Alpha/Beta Surveys

Alpha/beta surveys of the interior of the transite pipe exhibited count rates that ranged from 106 to 7,000 counts per minute (cpm), as shown in Figures 4-3a and 4-3b. Excluding the elevated locations in HA-1 and HA-4, the count rates ranged from 106 to 2,560 cpm. With the exception of HA-4-02, which had the highest alpha/beta count rate (6,500 cpm) measured in the RCA, transite pipe sections in HA-4 typically exhibited count rates of less than 1,000 cpm. Table 4-5 summarizes alpha/beta survey count rate results for measurements taken in the pipe interior. The results for each measurement location are provided in Appendix E.

Table 4-5. Pipe Interior Alpha/Beta Survey Results, cpm

Area	Max	Min	Average	Median
HA-1	7,000	1,600	2,575	1,900
HA-2	635	106	255	224
HA-3	420	330	386	406
HA-4	6,500	380	1,229	435
HA-5	430	295	342	322
HA-6	1,004	570	755	690
HA-7	2,560	880	1,365	1,122

4.2 Radiochemical Analytical Data

The bulk concentration samples for transite pipe and associated waste materials were analyzed for radium-226 and radium-228 by gamma spectroscopy (γ-spec; Method E901.1) and for total uranium and total thorium by ICP-MS (Method SW6020). The gamma spectroscopy analytical method provides results for all gamma-emitting radiochemicals including radium-226 and radium-228 (radium-226 is the basis for transite pipe removal action decision-making[3]). In addition, values for thorium-232, uranium-234, and uranium-238 were reported by the analytical laboratory (most samples did not have quantifiable concentrations of uranium-235).

The analytical laboratory (TestAmerica - Richland, WA) did not grind and homogenize the transite pipe bulk concentration samples before digestion and analysis to protect lab personnel from possible exposure to airborne asbestos fibers. Because the ICP-MS analytical method required a half-gram sample aliquot for analysis, lab personnel selected a representative 0.5 gram piece from the submitted 500 gram sample. Because the extraction of such a small aliquot from a non-homogenized sample has the potential to not be completely representative of the total sample, total thorium and uranium results reported by the ICP-MS method may not be as representative of the bulk concentration of total thorium and uranium as γ-spec analytical results.

The γ-spec analytical method used aliquots of approximately 200 milliLiters, equivalent to about 200 grams. The aliquots for the γ-spec analyses were also obtained without grinding and homogenization, but were composed of multiple pieces of transite pipe materials that represented the entire pipe thickness including scale and sediment found within the pipe interior. The approximate 200-gram aliquots were obtained by breaking the sample into multiple small pieces, blending those pieces in the sample container and manually selecting pieces from the sample container to represent the range of observed materials from the pipe exterior and interior. The larger sample size and method of selection of the sample aliquot produced a more representative sample for γ-spec analysis than the 0.5 gram sample submitted for ICP-MS analysis.

[3] Concentrations of radium-226 and radium-228 determined via gamma spectroscopy are based on the concentrations of decay products in equilibrium with radium-226 and radium-228.

As a result, concentrations of gamma-emitting radiochemicals (e.g., thorium-232 and uranium-238) analyzed by the γ-spec method are more reliable for decision making than samples analyzed by the ICP-MS method. Table 4-6 compares the results from the ICP-MS and γ-spec methods for Th-232 and U-238. The large variation in the calculated percent difference between the two results demonstrates the lack of comparability. Due to the more reliable representativeness of the sample aliquot for gamma spectroscopy analyses, the γ-spec results are the data values reported for thorium and uranium concentrations in this RAP, unless otherwise specified. Although not discussed further in this section of the RAP, analytical results from the ICP-MS analyses are provided in Appendix E.

Tables 4-7 and 4-8 summarize the radiochemical analytical results in both mass units (mg/kg) and activity units (pCi/g), which are also provided in Appendix E. Because the results for sample HA-1-07 were significantly higher than for any other sample, the analytical results for this sample (Table 4-4) were removed to calculate the values presented in Table 4-8. Uranium and thorium conversion factors of 0.33 and 0.11 pCi/g per mg/kg are based on U-238 and Th-232 activities of 3.3E5 and 1.1E5 pCi/g, respectively. For example, a U-238 concentration of 1 mg/kg would be equal to a concentration of 0.33 pCi/g. Conversely, by using the conversion factor, a uranium-238 concentration of 1 pCi/g would be equal to a concentration of 3.3 mg/kg. Background concentration limits (BCLs) presented in the *Background Soils Data Summary Report - Revision 1* (Brown and Caldwell, 2009b) for Sub-Areas A-1 and A-2 are also provided in Table 4-8 for comparison to the transite pipe data.

The radiochemical data summarized in Table 4-8 indicate that: 1) mean values for transite pipe radiochemical concentrations are consistent with background levels measured in off-Site alluvial soils; and 2) median values, relative to maximum and minimum values, indicate the occurrence of few samples with elevated concentrations. Only one transite pipe sample (HA-1-07) exceeded the Site-specific ARAR of 15 pCi/g of Ra-226 (Table 4-9).

Transite pipe samples from the RCA (HA-4-01 through -04) ranged from 0.328 to 0.585 pCi/g Ra-226. The highest Ra-226 value of 6.39 pCi/g was obtained from the field duplicate for sample location HA-4-02. Figures 4-4and 4-5, respectively, illustrate the anomalously high values of Ra-226/U-234/U-238 and Ra-228/Th-232 concentrations in samples HA-1-07 and HA-4-02 (field duplicate), and their relative magnitudes to one another and the remainder of the transite pipe bulk concentration samples.

Table 4-6. Thorium and Uranium Results (ICP-MS and γ-spec methods)

Sample	Th-232 ICP-MS pCi/g	Th-232 ICP-MS	Th-232 γ-spec pCi/g	Th-232 γ-spec mg/kg	% difference
HA-1-01	0.172	1.56	0.265	2.41	-35%
HA-1-05	0.183	1.66	0.371	3.37	-51%
HA-1-07	97.24	884	610	5545	-84%
HA-2-01	0.206	1.87	0.304	2.76	-32%
HA-2-03	0.341	3.1	0.367	3.34	-7%
HA-2-05	0.330	3	0.295	2.68	12%
HA-2-07	0.184	1.67	ND	-	-
HA-2-08	0.178	1.62	0.411	3.74	-57%
HA-2-09	0.147	1.34	0.192	1.75	-23%
HA-2-10	0.129	1.17	ND	-	-
HA-3-01	0.125	1.14	0.275	2.50	-54%
HA-3-03	0.308	2.8	0.298	2.71	3%
HA-3-03-FD	0.328	2.98	ND	-	-
HA-3-04	0.228	2.07	0.294	2.67	-23%
HA-4-01	0.526	4.78	ND	-	-
HA-4-02	0.166	1.51	0.198	1.80	-16%
HA-4-02-FD	37.18	338	23.4	213	59%
HA-4-03	1.936	17.6	0.431	3.92	349%
HA-4-04	0.325	2.95	0.502	4.56	-35%
HA-4-06	0.282	2.56	0.744	6.76	-62%
HA-5-02	0.272	2.47	0.346	3.15	-21%
HA-5-04	0.301	2.74	0.766	6.96	-61%
HA-5-04-FD	0.320	2.91	0.467	4.25	-31%
HA-6-02	0.453	4.12	0.677	6.15	-33%
HA-7-02	1.628	14.8	1.32	12.0	23%
HA-7-04	0.266	2.42	1.05	9.55	-75%
HA-1-01	0.366	1.11	0.501	1.52	-27%
HA-1-05	0.212	0.641	0.509	1.54	-58%
HA-1-07	180.180	546	116	352	55%
HA-2-01	0.776	2.35	0.426	1.29	82%
HA-2-03	1.082	3.28	0.539	1.63	101%
HA-2-05	0.739	2.24	0.466	1.41	59%
HA-2-07	0.469	1.42	0.627	1.90	-25%

Table 4-6. Thorium and Uranium Results (ICP-MS and γ-spec methods) - Continued

Sample	U-238 ICP-MS pCi/g	U-238 ICP-MS mg/kg	U-238 γ-spec pCi/g	U-238 γ-spec mg/kg	% difference
HA-2-08	0.380	1.15	0.464	1.41	-18%
HA-2-09	0.343	1.04	0.383	1.16	-10%
HA-2-10	0.305	0.923	0.61	1.85	-50%
HA-3-01	0.383	1.16	0.567	1.72	-32%
HA-3-03	3.251	9.85	0.416	1.26	681%
HA-3-03-FD	3.465	10.5	0.557	1.69	522%
HA-3-04	0.578	1.75	0.552	1.67	5%
HA-4-01	1.508	4.57	0.43	1.30	251%
HA-4-02	0.363	1.1	0.373	1.13	-3%
HA-4-02-FD	43.890	133	7.04	21.3	523%
HA-4-03	3.729	11.3	0.587	1.78	535%
HA-4-04	0.495	1.5	0.468	1.42	6%
HA-4-06	0.465	1.41	0.517	1.57	-10%
HA-5-02	0.696	2.11	0.736	2.23	-5%
HA-5-04	0.475	1.44	0.577	1.75	-18%
HA-5-04-FD	0.901	2.73	0.409	1.24	120%
HA-6-02	1.577	4.78	0.598	1.81	164%
HA-7-02	6.534	19.8	0.552	1.67	1084%
HA-7-04	1.680	5.09	0.325	0.98	417%

Table 4-7. Radiochemical Results

	Th-232 pCi/g	Th-232 mg/kg	U-238 pCi/g	U-238 mg/kg	Ra-226 pCi/g	Ra-228 pCi/g
Maximum	610	5545	116	352	95.4	599
Minimum	0.19	1.75	0.33	0.985	0.328	0.158
Mean	29.2	266	5.2	15.8	4.35	24.44
Median	0.39	3.55	0.53	1.60	0.47	0.36

Table 4-8. Radiochemical Results (HA-1-07 excluded)

	Th-232 pCi/g	Th-232 mg/kg	U-238 pCi/g	U-238 mg/kg	Ra-226 pCi/g	Ra-228 pCi/g
Maximum	23.43	213	7.04	21.3	6.39	24.9
Minimum	0.19	1.75	0.33	.985	0.328	0.158
Mean	1.57	14.3	0.77	2.33	0.71	1.45
Median	0.37	3.37	0.52	1.57	0.47	0.36
Sub-Area A1 BCL	1.65	15	0.96	2.9	2.05	2.24
Sub-Area A2 BCL	2.09	19	1.35	4.1	2.44	2.13

Table 4-9. Analytical Results for HA-1-07					
Th-232 pCi/g	Th-232 mg/kg	U-238 pCi/g	U-238 mg/kg	Ra-226 pCi/g	Ra-228 pCi/g
610	5545	116	352	95.4	599

As described above, three scale samples were collected from transite pipe bulk concentration sample locations with the most elevated radiometric readings to: 1) support the planned limited decontamination of loose scale in the transite pipe, described below in Sections 4.4 and 5.2; and 2) develop an upper concentration value expected for mixed asbestos-TENORM waste for transite pipe from HA-1 and HA-4. Table 4-10 presents the analytical results of the three scale samples for comparison to the bulk concentration sample results presented in Table 4-11.

Table 4-10. Scale Sample Radiochemical Results										
Location	Th-232 pCi/g	Th-232 mg/kg	U-238 pCi/g	U-238 mg/kg	Ra-226 pCi/g	Ra-228 pCi/g	Th-232 pCi/g (ICP-MS)	Th-232 mg/kg (ICP-MS)	U-238 pCi/g (ICP-MS)	U-238 mg/kg (ICP-MS)
HA-1-07	817	7,430	194	588	155	881	545	4,950	1,240	3,770
HA-4-01	ND	ND	2.13	6.45	2.31	1.16	0.89	8.12	3.56	10.8
HA-4-02	78.5	714	22.3	67.6	19.8	81.6	33.1	301	65.7	199

Table 4-11. Bulk Radiochemical Concentrations at Scale Sampling Locations						
Location	Th-232 pCi/g	Th-232 mg/kg	U-238 pCi/g	U-238 mg/kg	Ra-226 pCi/g	Ra-228 pCi/g
HA-1-07	610	5,545	116	352	95.4	599
HA-4-01	ND	ND	0.43	1.30	0.511	0.494
HA-4-02	0.198	1.80	0.373	1.13	0.328	0.273
HA-4-02-FD	23.4	213	7.04	21.3	6.39	24.9

The three scale samples contain higher concentrations of radiochemicals than measured in the corresponding bulk concentration transite pipe samples. The scale samples from HA-1-07 and HA-4-02 (FD) exceed the Site-specific ARAR of 15 pCi/g for Ra-226. The ratio of scale sample to bulk sample radiochemical concentrations for the HA-1-07 samples range from 1.34:1 to 1.66:1. The ratio of scale sample to bulk sample radiochemical concentrations for the HA-4-01 samples range from 2.35:1 to 4.95:1. The ratio of scale sample to bulk sample radiochemical concentrations for the HA-1-02 (FD) samples range from 2.28:1 to 3.35:1.

4.3 Data Quality Summary

A total of 23 primary and three field duplicate solid matrix samples were collected and analyzed to determine bulk concentrations of transite pipe and associated waste materials. Overall, data meet the data quality objectives and no data were rejected. With the exception of the ICP-MS data which were not used due the potential non-representative nature of the small aliquot selection method used by the analytical laboratory, all data are considered usable for the stated purposes and completeness goals were achieved for every method and analyte. Table 4-12 summarizes the number of samples analyzed by each method and the number of results that were qualified for each method for bulk concentration samples. The reasons for data qualification are:

- Matrix spike recoveries for total uranium and total thorium were outside of the control limits resulting in the qualification of all total uranium and total thorium results as estimated (J).
- Sample aliquots for total uranium and total thorium may not be completely representative of the bulk sample due to aliquot selection without complete sample homogenization.

Table 4-12. Analytical Completeness by Method (Bulk Concentration Samples)

				Number of results				Completeness	
Method	Parameter	Samples Analyzed (P+FD)	Analytes per sample	Total	Rejected	Estimated due to QC deficiencies	Estimated due to >MDL but <PQL+	Percent usable	Percent quantitative*
E160.3	Percent Moisture	23+3	1	26	0	0	0	100%	100%
E901.1	Radium-226, -228	23+3	2	52	0	4	35	100%	92.3%
E901.1	Thorium-232	23+3	1	26	4	2	N/A	84.6%	84.6%
E901.1	Uranium-234, -238	23+3	2	52	0	4	N/A	100%	100%
SW6020	Total Thorium and Uranium	23+3	2	52	0	52	1	100%	0.0%

Notes: Estimations due solely to results <PQL do not affect the calculated completeness
+ The QAPP does not have PQLs for thorium and uranium isotopes by Method E901.1
Calculations do not include any required field or laboratory QC samples, except field duplicates.
P = primary samples
FD = field duplicate samples

As described above, three samples of pipe scale were collected to assess the upper range of possible TENORM concentrations associated with the transite pipe. Table 4-13 summarizes the number of samples analyzed by each method and the number of results that were qualified for each method for the pipe scale samples.

Table 4-13. Analytical Completeness by Method (Scale Samples)

				Number of results				Completeness	
Method	**Parameter**	**Samples Analyzed (N+FD)**	**Analytes per sample**	**Total**	**Rejected**	**Estimated due to QC deficiencies**	**Estimated due to >MDL but <PQL+**	**Percent usable**	**Percent quantitative***
E901.1	Radium-226, -228	3+1	2	8	1	0	0	87.5%	87.5%
E901.1	Thorium-232	3+1	1	4	1	0	N/A	75%	75%
E901.1	Uranium-234, -238	3+1	2	8	0	0	N/A	100%	100%
SW6020	Total Thorium and Uranium	3+1	2	8	0	0	1	100%	0.0%

Notes: * Estimations due solely to results <PQL do not affect the calculated completeness
+ The QAPP does not have PQLs for thorium and uranium isotopes by Method E901.1

4.4 Conclusions and Recommendations

Given the age and period of service of the transite pipe, and the 5.76-year half life for Ra-228, Ra-228 concentrations in the pipe deposited as scale or sediments from process solutions should have noticeably decayed by September 2009 (i.e., observed Ra-228 concentrations are expected to be a combination of deposited Ra-228 and Ra-228 resulting from the decay of Th-232). Therefore, the Th-232 and Ra-228 radioisotopes should be approximately in equilibrium (i.e., the red line in Figures 4-6a and 4-6b). Although most values are within the range of uncertainty of this equilibrium ratio, some samples with Th-232 concentrations less than 0.4pCi/g (including four non-detects) exhibit excess Ra-228 concentrations (this may be a result of sample concentrations being close to the limits of detection). Overall, Ra-228 concentrations can be expected to remain constant, in equilibrium with Th-232.

As shown in Figures 4-7a and 4-7b, U-238 and Ra-226 are also present at ratios near 1:1 (i.e., the red line in the figures). The longer half-life of 1,599 years for Ra-226 means that no significant portion of a Ra-226 concentration has resulted from the decay of U-238 (and subsequent decay products). Thus U-238 and Ra-226 are present and/or were deposited in approximately equal concentrations.

Given that a majority of the analytical data indicates radiochemical concentrations at relatively low levels, the ability to establish quantitative correlations of alpha/beta or gamma survey results to radiochemical concentrations is limited. In particular, there was a lack of results spanning the range of interest (i.e., Ra-226 concentrations from 5 to 25 pCi/g), as only one result (HA-1-07) for Ra-226 was found to be greater than 15 pCi/g. However, as described below, radiometric surveys to be performed during the removal action will be used to establish conservative action levels to designate RACM or mixed asbestos-TENORM waste, relative to disposal options.

Based on the gamma and alpha/beta survey data described in Section 4.1, gross and net exposure rate and gross count rate action levels can be established to support the designation of transite pipe as RACM or mixed asbestos-TENORM waste with Ra-226 concentrations that may exceed the Site-specific ARAR of 15 pCi/g. ARC anticipates that a majority of the pipe sections can be characterized in place, with a select number having to be moved to an area with a steady background exposure rate.

The decision tree shown in Figure 4-8 provides the criteria to identify waste management approaches for all transite pipe sections and loose debris during the removal action relative to the Site-specific ARAR (e.g., deposition in the on-Site unlined landfill cell, or alternative methods such as deposition in an on-Site lined landfill cell or shipment to an appropriate off-Site waste repository). As shown in Figure 4-8, transite pipe sections with gross gamma readings less than or equal to 30μR/hr can immediately be designated for conveyance to the on-Site landfill cell. This action level of 30 μR/hr (gross gamma count) is based on the criterion of 6 μR/hr (net gamma count) above background, which is discussed in more detail below.

Background exposure rates at all locations averaged 26.7 μR/hr, with a high value of 60 μR/hr and a low value of 16 μR/hr. Excluding background measurements in the RCA, the average background exposure rate was 24.25 μR/hr with a maximum value of 44 μR/hr. The first step in the decision tree (Figure 4-8) is to characterize pipe sections in place based on a gross exposure rate action level of 30 μR/hr, which is approximately 6μR/hr above the average background exposure rate described above.

If the gross gamma count rate exceeds 30 μR/hr for a transite pipe section, or for an area of debris, the net gamma exposure rate would then need to be determined for that section or area (Figure 4-8). This determination can be performed in place under stable background conditions. The background exposure rate can be considered stable if it does not vary more than the expected variation in instrument response over an area exceeding the length of the pipe sections being evaluated (i.e., for a typical 13-foot pipe section, this criterion would imply that the standard deviation of the background exposure rate is less than 10 percent over an area at least 33 feet long and 20 feet wide, based on a 10-foot standoff distance around a 13-foot pipe section).

If the in-situ background gamma count rate is not stable, the pipe will be re-located to an area with a known stable background (presumably, to a construction staging area). Once the gamma reading is completed, pipe sections or debris areas with a net gamma radiation exposure rate value of 6 μR/hr or less can be conveyed to the on-Site landfill cell. The 6 μR/hr gamma count rate action level is conservative because it is twice the net gamma exposure rate of all non-RCA and HA-1 samples with concentrations less than the Site-specific ARAR of 15 pCi/g Ra-226 (all non-RCA and non-HA-1 samples were also less than half the ARAR). Areas with broken pipe or debris will be subject to the alpha/beta survey and associated action level described below, whether the gross gamma count rate exceeds the initial 30 μR/hr action level or not.

In order for the 6 μR/hr action level to be consistently applied, surveys during the removal action must be performed in areas where the background exposure rate is stable. Background exposure rates are anticipated to vary between locations, and the stable criterion described above would be determined in the field using best professional judgment by a qualified and trained health physicist with appropriate experience using the gamma survey instrument.

Gross and/or net exterior gamma radiation measurements will be performed at a minimum of three locations (each end and the middle) for an individual transite pipe section and one per 100 square feet for areas of debris. ARC anticipates that most pipe sections can be surveyed for net gamma readings in place (notable exceptions include the RCA and, potentially, portions of HA-1). The gamma surveys during the removal action will be performed in accordance with the procedures used during the field characterization activities described in Section 2.4.

Pipe sections with a net gamma exposure rate greater than 6 μR/hr will be subjected to additional screening in the form of an alpha/beta survey of the pipe interior. Results of the alpha/beta surveys described in Section 4.1 indicate that, with the exception of samples from the RCA and HA-4, all transite pipe samples with Ra-226 concentrations less than the Site-specific ARAR of 15 pCi/g Ra-226 had alpha/beta count rates of less than 3,000 cpm. The alpha/beta survey will be performed at each end of the pipe section, and on the portion of the interior pipe wall with the highest observable accumulation of sediment and/or scale (i.e., typically on the bottom of the pipe when in the pipe was use, but not necessarily the bottom under existing conditions).

Given that the majority of the alpha/beta survey results were less than half of the Site-specific ARAR, the proposed 3,000 cpm action level represents a conservative action level to designate transite pipe sections as suitable for disposal in the on-Site landfill cell or not. This approach is validated by the fact that sample location HA-4-02, with a count rate of 6,500 cpm, has a Ra-226 concentration of 6.4 pCi/g (measured in the field duplicate sample). Therefore, as shown in Figure 4-8, an action level of 3,000 cpm is recommended for the final field determination of pipe sections and areas of debris.

Pipe sections and, if practicable, areas of RACM debris with an average alpha/beta count rate greater than 3,000 cpm will be subject to further evaluation and possible remediation by the removal of interior scale. Because the majority of the radiochemicals are concentrated in the scale and sediments that can accumulate within the pipe sections, the removal of this material will reduce the bulk concentration of radiochemicals and associated radiometric readings. ARC plans to perform a limited decontamination step of emptying pipes of loose scale and sediment by gravity without using mechanical means to loosen fixed scale. For specific pipe segments that appear to have such loose materials, this step will be performed in a manner that will not have the potential to generate RACM or other waste streams (e.g. aqueous waste). Pipe interior materials collected during this limited decontamination procedure will be: 1) controlled during removal to prevent the potential spread of contamination; and 2) appropriately packaged, sampled and stored for subsequent disposal (i.e., these materials will not be placed in the unlined off-Site landfill cell under any circumstances).

As shown in Figure 4-8, after the removal of any loose interior materials, the pipe section will be subjected to a second net gamma survey and an alpha/beta survey. Pipe sections that still exceed the net gamma and alpha/beta action levels will be classified as asbestos-TENORM mixed waste and set aside for subsequent disposal, either within a lined on-Site landfill cell or taken to an appropriate off-Site waste repository during a subsequent removal action to be developed based on discussions with EPA. In summary, based on the accumulated field and laboratory data: 1) the steps described above have been designed to ensure that transite pipe and debris to be disposed of in the on-Site unlined landfill will fall below the the Site-specific ARAR of 15 pCi/g Radium 226; and 2) the amount of transite pipe and debris that does not meet the field criteria for on-Site disposal will likely comprise a small volume.

SECTION 5.0
PLANNED REMOVAL ACTION ACTIVITIES

Based on the results of the characterization data and recommended field screening approach described in Section 4.0, the transite pipe removal action activities listed below will be conducted by one or more contractors with the appropriate technical and health and safety credentials to perform the work. Once ARC's contractor procurement process is completed, the following removal action activities will be conducted:

- Roadway Improvements and Landfill Construction
- Radiometric Survey Field Screening
- Landfill Operations
- Institutional Controls for Pipe Left in Place
- Landfill Closure

As part of the procurement process for qualified bidders, a Site visit will be conducted to review the overall project area illustrated in Figure 5-1 and to assess potential Site-specific health and safety (H&S) or technical concerns (e.g., areas of buried transite pipe or locations adjacent to steep slopes and poorly maintained or unsafe access roads). Such transite pipe occurrences will require field judgments by the selected contractor(s) and ARC to determine if pipe can safely be removed, or if the pipe will need to remain in place with appropriate institutional controls. In addition, road improvements to access or convey the transite pipe will be evaluated during the Site visit. Transite pipe materials associated with mixed asbestos-TENORM waste (e.g., HA-1 and HA-4) will also be reviewed with the contractor(s) to assess potential worker H&S concerns.

As previously described in this draft RAP, ARC does not intend to decontaminate transite pipe with TENORM in the form of sediment or scale. Friable asbestos is not readily decontaminated, and the decontamination process has the potential to generate other waste streams (e.g., in aqueous media) that would need to be managed differently than the transite pipe or debris. As described in Section 4.0, emptying of loose scale and sediment from pipe segments by gravity (i.e., without mechanical means to loosen fixed scale) will be performed for specific pipe segments in a manner deemed to be safe by the Project Safety Manager. ARC plans to manage all loose scale and sediment derived from this limited decontamination activity as mixed asbestos-TENORM waste after the completion of the removal action activities described below.

The selected contractor will complete the applicable notification forms to be submitted to EPA and the State of Nevada 10 working days prior to beginning the removal action, as required by 40 CFR § 61.145 et seq. Although permits are not required, per § 121(e) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), ARC will conduct the removal action in accordance with the substantive requirements of all applicable Federal and State regulations (e.g., Nevada regulations for Industrial Class III landfills). Prior to the removal action, ARC will discuss these requirements with EPA to ensure regulatory compliance.

5.1 Roadway Improvements and Landfill Construction

The selected contractor will provide roadway improvements to allow safe access to all transite pipe sections and debris areas by appropriate equipment. The pipe removal is anticipated to be performed by thumbed trackhoe, forklift and an approximate 5-ton truck (e.g. F-550). Road grading equipment will be required to establish safe access to select transite pipe locations. Planned haulage routes and traffic flow patterns are shown on Figure 5-2.

The CAS indicated that a portion of HA-2 appears to have restricted road access (i.e., a portion of an intact transite pipe string located along the north-central portion of the W-3 waste rock pile, between the waste rock pile and the former Anaconda dump leach area). A section of the pipe string in this area is underlain, or immediately adjacent to, a collapsed road. Based on a determination to be made by the Project Safety Manager and ARC, the roadway will either be repaired and the currently inaccessible pipe segments removed, or the pipe will be left in place.

ARC anticipates that access to the landfill cell from the HAs located both north and south of Burch Drive will occur via the primary access roads shown on Figure 5-2, with secondary access along berms within the sulfide tailings, which can be used with local minor improvements. The approximate one-acre cell is located within an approximate 100-acre 'landfill area' on private property within the southern portion of the sulfide tailings area, as shown in Figures 5-1 and 5-2. The landfill cell location is sufficiently close to a vat leach tailings (VLT) borrow source for easy access to additional fill and cover materials that may be needed.

Landfill CERCLA and State of Nevada Requirements

The on-Site landfill design, construction, operation and closure activities will fall under EPA jurisdiction in accordance with applicable State of Nevada substantive regulations and guidelines, which include: 1) Office of Solid Waste and Emergency Response (OSWER) Directive 9355.7-03, USEPA, 2/19/92; 2) Nevada Revised Statutes (NRS) 459.7024; 3) the substantive requirements of Nevada Administrative Code (NAC) Chapter 444.731 for a Class III Industrial landfill, with the exception of the 100-foot depth to groundwater requirement and vegetated closure cap; and 4) the Nevada Department of Environmental Protection (NDEP) Fact Sheet - Mine Site Landfills. These guidance documents and regulations are provided in Appendix F1. Pursuant to the EPA-approved *Transite Pipe Removal Action Work Plan - Revision 1*, the landfill cell will be operated solely for the disposal of inert and asbestos-containing materials (i.e., all transite pipe and associated broken collars and loose debris recommended to be classified as RACM). Closure of the landfill cell will include signage that describes the nature of the type of waste within the cell.

Landfill Geotechnical Investigations

As described in the *Transite Pipe Removal Action Work Plan - Revision 1*, geotechnical investigations for potential landfill areas indicated relatively homogeneous sulfide tailings material characteristics (i.e., fine sand and silt, with very minor amounts of coarser sands and clays). Geotechnical data for the planned landfill cell are provided in Appendix F2 of this RAP. VLT and sulfide tailings geotechnical data will be made available to the selected contractor.

The depth of sulfide tailings in the landfill cell area exceeds 20-feet below ground surface (bgs), which means that the base of the landfill cell will be constructed completely within the sulfide tails. The depth to groundwater is approximately 90 feet bgs. Exploratory trenching did not intercept groundwater or saturated tailings beneath the planned landfill cell.

Landfill Cell Design

The on-Site landfill to be constructed for the transite pipe removal action will be based on the design elements described below. As shown in Figure 5-3, cell dimensions at the existing surface are approximately 290 feet long, including access ramps, 148 feet wide and 7 feet deep (note the 4x vertical exaggeration on the east-west [AA] and north-south [BB] cross-sections). The dimensions at the base of the excavation (i.e., bottom footprint) are approximately 150 feet long by 90 feet wide. The transverse slopes are designed at 4H:1V to facilitate excavation and cover operation by tracked equipment. All other slopes are no less than 3:1.

The floor of the cell is designed with a half-percent average slope, with a sump collection area located at its northeast corner, and includes a 12-inch compacted VLT base to provide stable access for rubber tired equipment (this thickness may locally increase as a result of field conditions). Floor materials will be compacted to 95 percent maximum dry density (MDD; ASTM D-698).

The landfill design includes two access ramps for trucks to enter, off-load RACM, and exit the cell without having to turn-around. The access and exit ramps are each designed with a 10 percent grade. Planned traffic patterns provide access into the cell from the west ramp for trucks to offload the waste, and the east ramp to be the exit ramp for empty trucks (Figure 5-2). The landfill cell design has been developed to optimize the range of transite pipe and associated materials listed in Table 5-1 (i.e., placing the largest diameter pipe, above 18 inches in diameter, in a single lift will allow the landfill cell to be constructed to the shallowest depth possible).

Table 5-1. Transite Pipe Length and Volume Estimates

Homogeneous Area	8-10" Pipe	12-14" Pipe	16-18" Pipe	22" Pipe	24" Pipe	Sub-totals	Estimated Broken Pipe/Collars/ Cubic Yard
Estimated Linear Feet Pipe - Piles							
HA-1	1,950	420	730	20		3,120	2
HA-2		150				150	10
HA-3	950	760	340		240	2,290	3
HA-4	100	770			30	900	5
HA-5		20				20	1
HA-6		100	180			280	1
HA-7	230	100	350	100		780	1
Sub total	**3,230**	**2,320**	**1,600**	**120**	**270**	**7,540**	**23**
Estimated Linear Feet Pipe - Pipe Runs							
HA-1							
HA-2		7,230				7,230	
HA-3	200	1,900	360	100		2,560	
HA-4	150	400				550	
HA-5		1,760				1,760	
HA-6		280				280	
HA-7		500				500	
Sub total	**350**	**12,070**	**360**	**100**		**12,880**	
Estimated Volumes							
Estimated Total (Linear Feet)	**3,580**	**14,390**	**1,960**	**220**	**270**	**20,420**	
Estimated Cubic Feet	**17,970**		**2,455**		**1,080**		**23**
Estimated Cubic Yards	**666**		**91**		**40**		**796**
Estimated Total Cubic Yards							**819**

The landfill cell design provides for approximately 6,300 cubic yards of fill capacity (i.e., excavation volume), which will accommodate: 1) the estimated volumes of intact transite pipe, associated broken pieces and bagged materials summarized in Table 5-1; 2) the 12-inch VLT base layer; and 3) minimum 12-inch thick layers of fill materials to be placed between the transite pipe lifts. Previously excavated sulfide tailings will be used to create the 12-inch thick layers of fill material to be placed between individual waste layers on a daily basis, as shown in Figure 5-4 (the 6-inch daily cover required by the NAC for landfilled RACM has been increased to 12 inches to accommodate compaction by tracked equipment). ARC anticipates that, during landfill operations, sulfide tailings fill materials will also fill in the spaces between individual pipe sections, broken pieces and bagged waste, which will stabilize their position within the waste layers. The majority of transite pipe occurs as intact sections of pipe with diameters that range from 8 to 24 inches. Larger diameter pipe sections (i.e., above 18 inches in diameter) will be placed as the basal waste layer in the cell (Figure 5-4). Details of the landfill cell are presented in Figure 5-5.

Excavated sulfide tailings will be stockpiled adjacent to the landfill cell for the alternating fill layers. VLT materials to be used for the landfill base and for the closure cap will be sourced from the oxide tailings area, located west of the landfill cell (Figure 5-1). In addition, VLT materials may be obtained from proximal berms and access roads within the sulfide tailings area.

5.2 Radiometric Survey Field Screening

As described in Section 4.4, the determination of whether to convey intact and broken transite pipe sections and areas of loose RACM debris to the on-Site landfill cell will be confirmed by radiometric surveys. The determination will be based on field radiological measurements, and will consist of the following nine steps (as summarized in Figure 4-8):

1. RACM and mixed asbestos-TENORM waste with gross gamma readings less than or equal to 30μR/hr can immediately be designated for conveyance to the landfill cell.
2. If the gross gamma count rate exceeds 30 μR/hr, the net gamma exposure rate will be determined, either in place under stable background conditions or at another location with known and stable radiometric background conditions (e.g., a pipe staging area).
3. Pipe sections or debris areas with a net gamma radiation exposure rate value of 6 μR/hr or less, measured in stable background areas, will be conveyed to the on-Site landfill cell.

4. The gross and/or net exterior gamma radiation measurements will be performed at a minimum of three locations (each end and the middle) for an individual transite pipe section, and one per 100 square feet for areas of transite pipe debris.
5. Pipe sections with a net gamma exposure rate greater than 6 μR/hr will be subjected to an additional alpha/beta survey of the pipe interior to be performed at each end of the pipe section, and on the portion of the interior pipe wall with the highest observable accumulation of sediment and/or scale.
6. Pipe sections with interior alpha/beta count rate results less than or equal to 3,000 cpm will be conveyed to the on-Site landfill cell.
7. Pipe sections with interior alpha/beta count rate results greater than 3,000 cpm will be subjected to: 1) decontamination (i.e., removal of loose interior sediment and scale), by gravity if possible; and 2) a repeat of steps (3) and (4).
8. Any pipe interior materials collected during decontamination procedure will be controlled to prevent the potential spread of contamination, and appropriately packaged, sampled and stored for disposal as part of a subsequent removal action.
9. Pipe sections that still exceed the net gamma and alpha/beta action levels will be classified as asbestos-TENORM mixed waste and set aside for subsequent disposal.

5.3 Landfill Operations

The landfill cell will be constructed per the design information presented in Section 5.1 and contractor means and methods. The contractor will be obligated to perform dust control activities during construction and operation to limit the potential for fugitive dust. Anticipated dust control activities are described below.

Removal action-related landfill operations will begin with the collection of transite pipe, broken pieces and RACM debris from the seven HAs, beginning with HA-5 and HA-7 that contain the oversize pipe (i.e., greater than 18 inches in diameter). These oversize pipe segments will be placed the first layer of RACM deposited on the VLT floor. All broken pieces or debris will be bagged or drummed prior to placement on the haul truck. All intact or broken pieces too large to be bagged or drummed will be sprayed with amended water and encapsulant spray prior to placement on the haul truck within each of the HAs.

No further amendments will be used prior to the placement of the RACM in the landfill cell unless intact pipe lengths are broken during transport, in which case encapsulant will be sprayed on broken edges of the pipe once placed in the landfill cell. Transite pipe will be positioned in the cell with the pipe lengths placed along both sides of, and parallel to, the east-west access road within the cell (Figure 5-4). Pipe sections will be placed at least 12-inches apart to accommodate the placement of fill materials. Bagged or drummed RACM (i.e., small broken pipe pieces and pipe collars), and other waste (e.g., coated metal pipe) will be placed along with intact pipe sections on the compacted VLT base or compacted layered fill (Figure 5-4). Subsequent layers of transite pipe and RACM debris will be filled in with, and covered by, sulfide tailings on a daily basis.

Placement of transite pipe within the landfill cell is designed to facilitate the use of trench compactors and manual tampers to compact the fill materials up to the spring line along the pipe lengths, and to the height of the pipe diameter between the pipe ends. As shown in Figure 5-5, a sheet of 60-mil textured HDPE will be placed with a 1-foot overlap over the pipe ends to aid in the distribution of soil loads along the pipe ends to mitigate soil settlement during compaction. The spacing between the pipe, perpendicular to their length, is also designed to facilitate standard pipe trench construction equipment to stabilize the pipe during backfill placement and compaction. Compaction will be performed to mitigate settlement and provide a working foundation for the next lift of pipe and fill materials.

Construction and operation of the landfill cell will: 1) use tracked excavation and vibratory steel drum compaction equipment and rubber-tired equipment; and 2) include geotechnical testing of VLT floor and fill layers. Geotechnical tests of sulfide tailings and VLT materials will include Index Tests for Gradation per ASTM C-136, Plasticity Index per ASTM D-4318, and Standard Proctor per ASTM D-698 per material type or change of material characteristics. Compaction tests using a nuclear gauge (per ASTM D-6398) will be performed on the compacted VLT floor and daily 12-inch covers at a frequency of one per 100 cubic yards of fill material or visible change of fill material type.

Compaction of fill over the top of each layer of pipe will be performed after the full 12-inch fill height has been achieved. At the end of each day of landfill operations, the waste materials placed in the landfill will be covered with sulfide tailings fill and sprayed with construction water to limit dust generation. During operations, the landfill cell will be subject to the following maintenance and control programs:

- The cell will be designated with a cell number, status (e.g., date open or date closed), removal action and waste type.
- Per NAC 444.976 (d), a daily cover will be placed over all RACM material placed in the landfill cell. ARC plans to increase the daily cover thickness from the required 6 inches to 12 inches to ensure that compaction activities will not adversely affect pipe integrity (i.e., avoid crushing during subsequent use of equipment in placing the next cell layer).
- Mitigation of potential dust generated during operations with construction water or palliatives, as appropriate, for the cell and associated fill material stockpiles. Construction water will be sprayed from a water truck and dust palliatives will be applied to stockpiled sulfide tailings that may be exposed for the duration of the removal action. Palliatives are anticipated to be water-solvent mixtures applied by spraying from water trucks. Dust mitigation for cell closure will use VLT materials as the uppermost 12 inches of the cover, placed with tracked or rubber-tired equipment.
- Compliance with applicable substantive State and Federal regulations (Appendix F1).
- Requirements associated with ARC's health safety, security, environment (HSSE) requirements and the updated Site-specific health and safety plan (HASP; Brown and Caldwell, 2009), as described in Section 6.0). Health and safety requirements include documentation of employee training and current refresher training certification, a medical surveillance program and documentation of employee medical monitoring, a comprehensive emergency response plan, and implementation of asbestos exposure monitoring. Personnel working with asbestos-TENORM mixed waste will include additional personal protective equipment (PPE).
- No burning, open flames or hot work demolition will be allowed.

5.4 Institutional Controls for Pipe Left in Place

As described above, the procurement process for qualified bidders will involve a Site visit to determine potential Site-specific health and safety or technical concerns, particularly in areas where access to transite pipe appears limited or not possible (e.g., portions of HAs adjacent to the open pit, slightly buried by berms, associated with collapsed roadways, and within steep slopes associated with tailings or waste rock). Such areas will require field judgments to determine if transite pipe can be safely removed with the design of special procedures, or if the pipe will be left in place with appropriate institutional controls.

Criteria for leaving transite pipe in place include locations where: 1) it is unlikely that transite pipe will pose a potential inhalation risk for Site workers; and 2) worker health and safety, and equipment, may be at risk during the removal of pipe or associated RACM waste materials. Institutional controls for leaving pipe or associated RACM waste materials in place include:

1. ARC's authorization to work program to control access to areas with transite pipe. Work will not be authorized for any areas containing remnant transite pipe unless authorized or supervised by a licensed asbestos abatement contractor or AHERA certified inspector.
2. Inclusion of potential asbestos hazards in future Site orientations and H&S training to visitors and contractors working at the Site. Such training will be in accordance with comply with requirements under OSHA Construction Industry Standard for Asbestos (29 CFR § 1926.58) and OSHA General Industry Standard for Asbestos (29 CFR § 1910.1001). At a minimum, employees with the potential to come in contact with transite pipe will be provided an awareness level training in accordance with OSHA standards (29 CFR § 1926.1101(k)(9)(viii)(A-J)).
3. Implementation of emergency response procedures for ceasing work, securing the affected location, and notifying an abatement contractor when a potential fiber release episode has occurred.

The following practices will be implemented for Site workers with the potential to encounter transite pipe or associated RACM waste materials in place:

1. All employees and contractors should avoid damaging transite pipe in any manner including, but not limited to, striking cement pipe with equipment or performing maintenance and repair activities that may impact the cement pipe
2. All employees and contractors should report any evidence of dust or debris that might be sourced from the transite pipe left in place, and any observable change in the condition of the pipe. Employees and contractors should avoid disturbing the remnant pipe
3. Employees and contractors should not be allowed to clean up, remove or repair any transite pipe that remains on the Site unless they have training for handling RACM, as required by the OSHA in 29 CFR § 1926.1101.

4. Transite and (asbestos) wrapped metal pipe left in place and exposed to the atmosphere will be managed by: 1) GPS mapping for future reference for Site workers, contactors or other individuals that would need to access those areas; and 2) placing appropriate signage alerting Site workers, contactors or other individuals that such pipe is present.

5.5 Landfill Closure

The landfill cell will be capped with 30 inches of combined non-compacted tailings materials above existing grade, which will be composed of a lower 24-inch layer of mixed sulfide and oxide tailings and an upper 6-inch layer of VLT. The cover geometry includes 4:1 maximum side slopes with a five percent grade to limit cap erosion during precipitation events.

Following the removal action and placement of the landfill cell closure cap, ARC plans to implement a soil moisture monitoring program within and beneath the 30-inch closure cap to provide real-time soil moisture data at three depths in the upper 10 feet of the combined cap and underlying below-grade fill material within the landfill cell. Details of performance monitoring will be discussed with EPA in a technical meeting prior to implementation. Soil moisture monitoring will be accomplished through the installation of time domain reflectometry (TDR) probes installed in a vertical or inclined borehole. Initial calibration of the TDR probes will be performed by the collection of cap and landfill materials, and the submittal of these samples to a geotechnical lab for gravimetric soil moisture measurements (ASTM D2216). Depth-specific changes, if any, of soil moisture data from the monitoring system will be evaluated on a quarterly and annual basis to: 1) assess the potential flux of meteoric water into the landfill cell; and/or 2) determine if any modifications to the cap soil moisture monitoring program should be implemented.

The closed landfill cell will be contained within the fenced and posted limits of restricted public access for the Site. Appropriate signage (e.g., as shown on Figure 5-4) will be posted at landfill area access road entrances listing the type of waste placed in the landfill. Specific language will be discussed with EPA prior to posting the signs.

5.6 Removal Action Schedule

An updated schedule for the transite pipe removal action is presented in Appendix H. A schedule for the management of mixed asbestos-TENORM waste will be developed with EPA after the conclusion of the transite pipe removal action, which may be affected by a removal action associated with radiological materials in the Process Areas.

SECTION 6.0
HEALTH AND SAFETY REQUIREMENTS

All field activities will be conducted in accordance with the Site Health and Safety Plan (HASP; Brown and Caldwell, 2009c). The HASP identifies, evaluates and prescribes control measures for health and safety hazards, including radiological hazards, and describes emergency response procedures for the Site. HASP implementation and compliance is the responsibility of Brown and Caldwell, with ARC taking an oversight and compliance assurance role. Copies of the HASP are located at the Site and are available to all Site workers. The HASP includes site specific requirements and procedures including:

- Safety and health risk or hazard analysis;
- Employee training requirements;
- Personal protective equipment (PPE);
- Medical surveillance;
- Site control measures (including dust control);
- Decontamination procedures; and
- Emergency response.

6.1 Training

All Site workers and subcontractors will receive applicable training, as outlined in 29 CFR 1910.120(e), and as stated in the HASP. Site-specific training will be covered at the pre-entry briefing, with an initial Site tour and review of Site conditions and hazards. Records of pre-entry briefings will be maintained at the project site. Personnel entering restricted work areas will be trained to identify RACM and the hazards associated with asbestos in accordance with the OSHA Asbestos Standards (29 CFR 1910.1001 and 29 CFR 1926.1101) and state/local certification requirements. This training provides personnel with a better understanding of asbestos and the steps to be taken to protect themselves and the public. Planned training elements include:

- Persons responsible for site-safety;
- Site specific safety procedures;
- Site-specific safety and health hazards;
- Project and task specific work risk assessment and mitigation;
- Use of PPE;
- Decontamination procedures; and
- Emergency response procedures.

Other required training, depending on the particular activity or level of involvement, that will be completed prior to beginning work at the Site includes the following. Sub-contractors and Site workers will provide copies of the following certification records to the Project Safety Manager:

- OSHA 40-hour training with current 8-hour refresher,
- AHERA Asbestos Inspector, Supervisor or Worker,
- Respirator training and fit test certification.

6.2 Personal Protective Equipment

Minimum PPE requirements required for transite pipe removal action activities include:

- hard hat;
- safety glasses;
- steel-toe boots;
- long-sleeve shirts;
- high-visibility clothing or reflective vest;
- nitrile and/or leather work gloves (as needed);
- Tyvek coveralls (as needed); and
- half mask respirator with P100 cartridge (as needed).

Additional PPE may be required depending on the work task and may include, but is not limited to goggles, fall protection and/or hearing protection.

6.3 Asbestos Health and Safety Procedures

This section identifies the principle hazards associated with the tasks to be performed during the asbestos abatement and removal action, and establishes standard safety and health procedures for Site workers. Activities conducted by any subcontractors and their designees will be performed in accordance with the Site HASP, this RAP and applicable federal, state, and local regulations.

6.3.1 Responsibilities

Primary Contractor

The Project Manager will have overall responsibility for ensuring health and safety protection on the Site and for ensuring that all elements of the HASP are implemented during all phases of the daily on-Site activities of this project. The Project Safety Manager will oversee the health and safety of site work to ensure the requirements of the HASP are followed and will communicate with all parties when changes occur on-site or when conditions impacting the site occur concerning the response actions to be taken. Each contractor on the job will be responsible for:

- Preparing a subcontractor HASP specific for their scope of work (SOW);
- Having an on-Site supervisor who understands the SOW and associated health and safety issues, and who can manage and control the health and safety issues;
- Supplying personnel qualified to perform the SOW tasks that they are assigned;
- Communicating with the Project Safety Manager and other subcontractors when work conditions are identified that can impact health and safety on the job;
- Ensuring training of the Subcontractor's employees in the recognition, avoidance and control of chemical, biological and physical hazards present at the Site;
- Maintaining records for Subcontractor employees as required by this HASP (including but not limited to) medical, training and fit-test records;
- Providing daily health and safety briefings to their personnel;
- Providing specified PPE and associated training; and
- Ensuring that all subcontractors and suppliers comply with the Site HASP.

6.3.2 Asbestos Hazard Assessment and Controls

The primary chemical hazard that may be encountered during this project is asbestos. Therefore, the Project Safety Manager will ensure that all Site workers receive the required training concerning asbestos, such as asbestos awareness training. In addition, personnel who have the potential to disturb RACM will be trained concerning the procedures to be used and requirements for notifications in accordance with federal/state/local regulations. Personnel who handle RACM will: 1) have the required documented training and licenses; 2) have completed asbestos awareness training; and 3) be a licensed asbestos worker and/or supervisor. Training, medical and license documentation for each subcontractor employee will be verified by the Project Safety Manager prior to start of work.

Engineering Controls

Technically feasible engineering controls and/or other protective measures to protect the safety and health of all employees include:

- High-efficiency particulate air (HEPA) filtration devices to reduce dust levels;
- Vacuum cleaners equipped with HEPA filters;
- Fume educators attached to HEPA filters for all hand-powered tools; and
- Other task-specific engineering controls as recommended by OSHA guidelines or as recommended by the Project Safety Manager.

Administrative Controls and Work Practices

Subcontractors will implement administrative controls and work practices as a secondary means of ensuring worker health and safety when engineering controls do not provide sufficient protection or are technically infeasible, such as the following:

- Ensuring all employees have current fit-test and training certifications;
- Implementing work practices that avoid generating dust whenever possible; and
- Requiring employees to implement decontamination procedures (washing hands, face, hair and neck upon leaving the work area and before eating, drinking or smoking).

Site Controls

Restricted work areas will be designated in the active work zone where only authorized personnel are allowed to enter while asbestos removal activities are being conducted. Persons entering the Regulated Work Area (RWA) will be trained in asbestos hazards and identification and will wear the required PPE (e.g. Tyvek coveralls and respirator). Persons leaving the RWA will follow personal decontamination procedures including the removal of protective clothing layers.

6.3.3 Respiratory Protection Program

Respiratory protection is required whenever work is performed inside the RWA to protect the workers from exposures to contaminants, primarily asbestos, that may be present. Particulate filters that are HEPA or P100 will be required. The following respiratory equipment practices will be conveyed to all employees, and enforced by the Project Safety Manager:

- Personnel that need to wear respiratory protection will have a written respiratory protection program that meets OSHA requirements (29 CFR 1910.134), and will be fit-tested, medically qualified and trained to use respiratory protection.
- Procedures will be developed for handling, storing and maintaining respiratory protective equipment for on-Site use including the process for reporting and repairing/replacing defective equipment and the locations where respiratory equipment will be stored.
- Contractors will provide employees with adequate respiratory protection as required for each task (disposable dust masks are not considered adequate respiratory protection).
- A respirator of lesser protection than required for the task/activity may not be used, unless sufficient full-shift personal air monitoring of a representative ‘worst-case’ situation, or negative exposure assessment (NEA), has been conducted and approval has been obtained by the Project Safety Manager to support a downgrade in respiratory protection.
- Each employee will change his/her respirator filter as often as needed, and the Subcontractor will provide an adequate supply of approved filters.
- Contractors will ensure respiratory protection adequacy based on the results of personal air sampling (downgrades must be approved by the Project Safety Manager).
- If air sampling data indicate exposures that exceed one-half of the OSHA Permissible Exposure Limit (PEL), respiratory protection for affected employees will be upgraded.

Respirator Testing

Individuals will be required to be clean-shaven where the sealing areas of the respirator face piece contacts the face, and will be respirator fit-tested in accordance with 29 CFR 1910.134. Upon donning the respiratory device, or before entering any restricted work area, each respirator wearer will be required to perform a manual negative and positive-pressure test. Workers who fail the negative/positive pressure test because they are not clean shaven will be required to leave Site or shave on-Site immediately preceding entry into the work area.

Respirator Inspection, Sanitization, and Maintenance

All respirators will be cleaned, sanitized, inspected, assembled, and maintained ready for use on a daily basis. Each respirator will be stored in a clean and sanitary container. Prior to use, the wearer will inspect the respirator, including the valves, valve covers, nosepiece, straps, eyepiece (for fullface respirators), face piece and its snaps, cylinders, and canisters to insure that the respirator can be worn. The Subcontractor will provide initial training concerning the use of respirator equipment, but each employee will be responsible for cleaning, inspecting, maintaining, sanitizing, and storage of his/her respirator equipment.

If a respirator becomes chemically contaminated or malfunctions, the respirator will be replaced with a clean and sanitized respirator, and the contaminated/ defective respirator will be decontaminated and repaired before reuse, or tagged ‘out of service’ and disposed of. The respirator wearer will inspect the replacement respirator for defective parts and leaks and will be fit tested if the replacement respirator is of a different make, model or size than the original.

6.3.4 Air Monitoring Plan

A qualified person will perform area air monitoring during the initial removal activities to evaluate exposures to asbestos within and outside of the work area. The evaluation will determine the effectiveness of control measures, requirements for upgrading or downgrading PPE, and the effectiveness of safe work practices. The subcontractors will be responsible for performing appropriate OSHA personal air monitoring on their workers.

Exposure Monitoring During Asbestos Removal

Two types of exposure monitoring will be conducted during the asbestos removal action, area sampling and OSHA personal monitoring. Area sampling is air monitoring that is conducted in and around the work area. Area monitoring will be conducted during all phases of the removal action, and is subject to different limits depending on the phase of work being performed. Air monitoring is an important control for asbestos work to ensure that no one is unexpectedly exposed to asbestos fibers in the surrounding area. A third-party contractor unaffiliated with the owner or asbestos removal contractor is required to take these samples. OSHA personal monitoring requires that a representative number of the workers performing each task during the removal action be monitored using a personal air monitor properly attached to their person.

Requirements for Negative Exposure Assessment

NEAs may be performed to demonstrate that the work will not generate asbestos fibers in the air at levels exceeding the PEL. If performed, NEAs can be used to demonstrate that the asbestos abatement contractor does not need to comply with a number of regulatory requirements. However, this demonstration must be based on previous jobs with the same material, objective manufacturer data or an initial exposure assessment. NEAs may also be used to determine what level of respirator protection is needed.

6.4 Radiological Dose Assessments and Contamination Monitoring

Transite pipe removal activities performed in HA-1 or HA-4 (RCA), where elevated radiometric readings have been observed may involve the following monitoring: 1) worker external and internal exposure; and 2) monitor removable contaminant levels on equipment and personnel to minimize the spread of contaminants on or off the Site. These areas will be marked with exclusion flagging and signs, and Site workers will be required to wear additional PPE.

External Radiological Dose Assessment

External radiation dose monitoring will be performed on all Site workers working in or near the designated RCA and, if required, HA-1. Personal dosimeters, such as thermo-luminescent dosimeters (TLD), or optically stimulated luminescence (OSL) badges will be used to monitor cumulative radiation doses. Dosimeters will be submitted to a laboratory following completion of the work, or after a one-month period, whichever is shorter (replacement dosimeters should be worn until the work is completed). An electronic dosimeter may also be worn to provide a real-time reading of worker exposure levels to know if very high exposures are occurring during the course of the work, though these are considered to be less accurate and should not be used in place of the TLD/OSL. Analysis of the TLD/OSL badges or electronic dosimeters will be evaluated in the context of a to-be-established action level. Employees with exposure levels close to or greater than this action level will be removed from the work activity.

Internal Radiological Dose Assessment

A high volume sampler will be used to collect representative air samples once per each day that removal actions are performed in the RCA (and HA-1, if required) to determine airborne levels of radioactivity. The sample filters will be analyzed for total particulate mass as well as specific radioisotopes identified as occurring in the waste material to allow an estimate of internal radiation exposure. The air sample will be collected during the period of waste handling activities by placing a sample pump and filter on the downwind side of the work area at the border of the contamination control zone. Meteorological conditions during air sampling will be recorded to correlate these conditions with measured airborne concentrations.

Radiological Contamination Control Monitoring

A contamination control zone (CCZ) will be established around the RCA (and portions of HA-1, if required) to accommodate the removal action. Personnel and equipment within the CCZ will be monitored for surface radiological contamination prior to leaving the area using a survey meter with a probe suitable for measuring alpha/beta contamination that reads in disintegrations per minute (DPM). Accessible surfaces of equipment or persons must measure below 200 DPM per 100 square centimeters (cm^2) of removable contamination, below 3,000 DPM per 100 cm^2 maximum fixed contamination and below 1,000 DPM per 100 cm^2 fixed contamination averaged over one square meter above Site background levels for unrestricted release from the area.

If surfaces show activity levels greater then 200 DPM per 100 cm^2 above background, they will be cleaned until the prescribed level is met. All disposable PPE worn in the CCZ must be removed upon exit, disposed of in plastic bags and stored in labeled 55-gallon drums to be evaluated and disposed of as investigation derived waste. Non-disposable PPE must meet the same release requirements as those defined above. The prescribed frequency of contamination control monitoring is summarized in Table 6-1. This frequency may be modified as additional data becomes available.

Table 6-1. Contamination Control Monitoring/Sampling Frequency

Frequency[a]	Location of Condition[a]
Prior to Transfer	Of equipment and material from a Radiological Control Area.
Daily	At contamination area control points, change areas, or step-off pads when in use, or per shift in high use situations.
After	Clean up of a leak or spill of radioactive materials in previously uncontaminated areas.

Note: [a] Contamination surveys will be conducted in Radiological Buffer Areas established for the control of contamination and other areas with the potential for spread of contamination.

6.5 Landfill Construction and Management Health and Safety Procedures

The landfill for disposal of RACM waste will be constructed on site in the sulfide tailings area as described in Section 5.0. Health and safety issues related to landfill construction, waste hauling and landfill operation include ground disturbance, airborne dust and vehicle traffic. Because the planned disposal of transite pipe in the on-Site landfill cell does not include mixed asbestos-TENORM waste, which will be managed in a subsequent removal action phase, the following discussion is limited to the relocation of RACM to the landfill cell.

6.5.1 Ground Disturbance

Construction of the landfill cell includes excavation of sulfide tailings to the design configuration described in Section 5.0. While there is very little risk of encountering buried utilities in the sulfide tailings, ARC will conduct utility location activities and prepare a ground disturbance permit. The open excavation will be treated as a potential permit-required confined space until it can be verified that there are no inhalation or engulfment hazards. Once the excavation is large enough, air monitoring will be conducted to evaluate oxygen, carbon monoxide and hydrogen sulfide levels. The excavation will also be monitored to ensure that it is constructed to conform to the engineering design (i.e., no vertical walls that could collapse and engulf personnel or equipment). If both inhalation and engulfment hazards are determined to not exist, the excavation will be listed as a non-confined space. If conditions change through the construction and operation of the on-Site landfill, additional air monitoring may be implemented and confined space procedures may be required.

6.5.2 Dust Control and Air Monitoring

Generation of sulfide tailings dust during landfill cell construction, operation and closure will be monitored for potential exposure levels for both on-Site workers and off-Site receptors. Dust control procedures (e.g., wetting the surface of the sulfide tailings and access roads, or covering the access roads with gravel) will be implemented to minimize the amount of dust. Personal air pumps will be used to monitor individual breathing zones of Site workers.

High volume air samplers will be established around the perimeter of the landfill cell work area (not necessarily at the Site perimeter) to monitor dust that may travel to potential off-Site receptors. Air monitoring will be done daily for the first week of the landfill cell construction, and may be reduced in frequency if results show acceptable levels of fugitive dust emissions below regulatory levels. Collected air monitor samples will be analyzed for total particulates less than 10 microns (PM_{10}), asbestos fibers and select metals known to occur in the sulfide tailings.

6.5.3 Traffic Control

A traffic control plan will be established at the start of the removal action by the selected contractor to define access routes that trucks and equipment are allowed to use (or are excluded from), designated directions of travel, areas limited to one-way traffic, and traffic management procedures for areas with two-way traffic or intersections. All removal action-related traffic will be confined to the Site with the exception of mobilization to and from the site at the beginning and end of the removal action. Traffic control on public roadways will not be required.

6.6 Work Risk Assessment

Work Risk Assessment (WRA) is a risk management tool for the identification and ranking of hazards associated with all aspects of a specific job before and after implementation of risk controls and preventive actions. Control of the hazards can be accomplished by elimination or substitution of the task, isolation of Site workers from the hazard, use of engineering or administrative controls, and/or the use of PPE. The WRA for the removal action described in this RAP is provided in Appendix G. A summary of potential hazards associated with the removal action activities described in this RAP is provided in Table 6-2.

ARC will create Task Safety and Environmental Analyses (TSEAs) for the contractor to perform individual tasks that comprise the removal action. TSEAs are similar to job safety analyses (JSAs), but include potential risks to the environment. Comprehensive TSEAs will be completed for all field tasks required in this RAP before the work is initiated and will be developed jointly by the field staff conducting the work and the Project Safety Manager. TSEAs will be kept at the Site at all times and will be reviewed by Site workers prior to, and throughout, the removal actions in order to identify new hazards or controls.

Table 6-2. Work Risk Assessment Summary

Field Activities	Potential Hazards
Radiation survey of transite pipe	▪ Driving hazards ▪ Walking, tripping, uneven ground surface ▪ Radiation exposure
RACM material sampling	▪ Inhalation of asbestos fibers ▪ Skin contact or clothing contamination with fibers ▪ Hand injury from handling material ▪ Eye injury ▪ Contact with chemical residue ▪ Exposure to radioactive materials
Sampling or removal in the RCA	▪ Radiation exposure ▪ Inhalation of alpha particles ▪ Tracking of contaminated materials to vehicle or other areas
Pipe removal and loading	▪ Mobile equipment activity (all-terrain forklift) ▪ Material handling, hoisting ▪ Inhalation or skin contact with RACM, radiological or chemical residue ▪ Steep terrain, narrow roadways, limited access
Transport of pipe to on-site landfill and operation of the landfill	▪ Driving hazards ▪ Limited access and maneuverability, backing in loading/unloading areas ▪ Steep hills and unprotected embankments ▪ Dispersal of RACM during transport
Construction, operation and closure of the on-Site landfill cell	▪ Mobile equipment activity (all-terrain forklift) ▪ Material handling, hoisting ▪ Inhalation or skin contact with RACM, radiological or chemical residue ▪ Steep terrain, narrow roadways, limited access

SECTION 7.0

REFERENCES

Brown and Caldwell 2009a, *Transite Pipe Removal Action Work Plan*, *Revision 1, Yerington Mine Site, Lyon County, Nevada*. Prepared for Atlantic Richfield Company. August 19.

Brown and Caldwell 2009b, *Background Soils Data Summary Report, Revision 1, Yerington Mine Site, Lyon County, Nevada*. Prepared for Atlantic Richfield Company. March 9.

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